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JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA,

FOR THE PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE,

Civil Engineering, the Arts and Manufactures,

AND THE RECORDING OF

AMERICAN AND OTHER PATENT INVENTIONS.

EDITED BY

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PROMOTION OF THE MECHANIC ARTS.

JULY, 1857.

CIVIL ENGINEERING.

*The Relative Efficiency of the Screw and Paddle Wheel when applied to Vessels of Identical Form, Tonnage, and Steam Power, independent of the use of Sails.**

The comparative results of the *Himalaya* and *Atrato* afford the best opportunity of testing the relative efficiency of the screw propeller and paddle wheel, and examples for exhibiting the system proposed in the Arithmetic of Naval Architecture, by which the economy of the engines can be calculated by means of the formula $V^2 = \frac{2}{3} \frac{\text{Ind. H. P.} \times 100}{\text{Mid. Sec.}}$.

The Himalaya.

Displacement,	3220 tons.
Nominal H. P.,	700
Ind. H. P.,	2050
Midship section,	560 sq. ft.
Draft of water forward,	15 ft. 3 ins.
Draft of water aft,	18 ft. 3 ins.
Rate in statute miles,	15·87
Rate by formula,	15·75
Consumption of coals,	80 tons per day.

The effective H. P. required for the above midship section, and rate by the formula (conceded as a standard), is 1367, and £50 per nominal H. P. taken as a basis for testing the economy of the engines, the value of the E. H. P. becomes £25 12s. per horse; and assuming 15·87 miles as her working rate, as an example, the consumption of E. H. P. is 5·4 lbs. per hour, or one ton of displacement carried one mile, by the consumption of ·146 lbs. of coal, at the rate of 15·87 miles per hour.

* From the Lond. Artizan, April, 1857.

	Atrato.
Displacement,	3070 tons.
Nominal H. P.,	900
Ind. H. P.,	3070
Midship section,	544
Draft of water forward,	16 ft. 4 ins.
Draft of water aft,	16 ft. 8 ins.
Rate,	16·08 miles.
Rate by formula,	19·40 "
Consumption of coals,	96 tons.

In this vessel, the E. H. P. required for the above rate and midship section is 1403, therefore, with the previous suggestion, the value of that power becomes £32 1s. per horse, the consumption of E. H. P. 6·3 lbs. per horse, or 1 ton of displacement, carried 1 mile, by the consumption of ·181 lbs. of coal, the efficiency and economy of the two vessels would stand thus :—

	Himalaya.		*Atrato.*
Value of engine,	£25 12s.	....	£32 1s.
Consumption of E. H. P.,	5 4 lbs.	....	6·3 lbs.
One ton of displacement carried 1 mile,	·146 lbs.	....	·181 lbs.
Ratio of actual weight to formula speed,	100	....	83

Therefore, the engine of the *Himalaya* is 20 per cent. cheaper than that of the *Atrato*, the consumption of E. H. P. 14 per cent. less, the displacement carried about the same, and the efficiency for speed of the *Atrato* 17 per cent. less than the *Himalaya ;* consequently, in these examples, the screw is more efficient and economical than the paddle in every respect.

Mr. Scott Russell said the matter stands thus: let it be supposed that there has to be propelled 1 ft. square of midship section at the rate of 5 miles per hour, and another at the rate of 10 miles per hour, then if the resistance to that square foot at 5 miles per hour be 5 lbs., according to the usual known law of the resistance being as the square of the velocity, the resistance at 10 miles would be 20 lbs.; but this resistance of four times that amount is acting over double space in an hour, and therefore they must take the four and double it again, for the measure of the power *developed* in that time necessarily and unavoidably as the cube of the velocity.

The use of the word "power" amongst engineers was the force developed for an hour or for a day; at all events, it was the power developed in a given time, and this consisted of two elements, viz: force, and the space moved over.

Everybody puts engines in a vessel upon the principle, that the resistance increased as the square of the velocity, and the H. P. as the cube of the velocity.

Mr. R. Griffiths said, having myself been present at the experiments that were made on her Majesty's ship *Flying Fish*, at Portsmouth, there appears to me much more valuable information to be derived from those trials, bearing upon the subject under discussion, than was stated here last Tuesday by Mr. Samuda ; so much so, that it clearly proved to my mind that *neither the square nor cube* of the power is correct, with regard to increased speed to be obtained by vessels on being propelled through

the water. The *Flying Fish* is built with beautiful lines both at the bow and stern, and when tried on July 3d, the engines made 74½ revolutions per minute, Ind. H. P. 1106·06, which gave her a mean speed of 11·603 knots; and with three-quarter power, or 68¼ revolutions, Ind. H. P. 877·0, gave a speed of 11·201; and at half power, or 59 revolutions, and 576 Ind. H. P. gave a speed of 9·923 knots: thus, while the power was doubled, the increased speed was only 1·680 knots, which considerably exceeds even the cube of the power.

After this she had a temporary bow fitted on, so as to give her a finer entrance; but no other alteration whatever was done, and on September 16th again tried, when the engines made 77 revolutions, Ind. H. P. 1309, which then gave her a mean speed of 12·572, and with three-quarter power, or 68 revolutions, and 918·72 Ind. H. P., gave a speed of 11·150, and at half-power or 60 revolutions per minute, Ind. H. P. 660·18, a speed of 10·120; thus, by doubling the power with the false bow, gave her an extra speed of 2·452 knots, or just what was due to the cube of the extra power exerted. But the most interesting fact is, that when working at half and also at three-quarter power, no increase of speed was obtained from the application of the temporary bow, while with full power an increase of nearly one knot was obtained. This, I think, must be evident to all parties, that the form of the ship ought to be made suitable to the power intended to be applied to her; and until naval architects are able to solve this important point, we are doomed still to proceed by the old rule of thumb and haphazard system of building ships.

Mr. Bidder's observation last Tuesday evening, on the great advantage obtained in speed by large vessels over small ones, relative to the power exerted, does not appear to me to be correct, for the same advantage is obtained by the large vessel in smooth as well as rough water, or, were the advantage due to momentum, even in rough water the smaller vessel might be made equal to the larger one, by simply giving her a heavy fly-wheel on the driving shaft; but that no advantage could possibly result by so doing should be evident to every one; the advantage gained is due to quite another source; a ship in being propelled through the water, strikes it with her bow from a state of rest into motion, and when it is once put in motion, the power required to keep it up is much less in proportion than was required to start it. Since both the small and the large vessel has to divide and set the water in motion; it is clear how the large vessel gets so great an advantage over the small one. I will now bring a case before you, which, I think, proves the correctness of this theory.

Last month Messrs. Summers and Day, of Southampton, fitted one of my screws to the screw steamer *Dane*, of 40 H. P., 500 tons measurement; her original screw was 10 ft. 6 in. diameter, 18 ft. pitch, with three blades, each 3 ft. 4 in. wide at the points, and 1 ft. 10 in. at root, which gave the vessel a speed at the measured mile of 8·50 knots. The object in applying my screw was to enable the ship to sail with the screw fixed, and it was, consequently, made as narrow as possible, so that it occupied but a very little more space than the width of the stern post, looking fore and aft, the diameter and pitch being the same as the three-bladed screw; but the points of the blades were only 9 ins. wide, and

3 ft. at the root. Now, with only this narrow strip of a blade, the vessel made 8·675 knots, the pressure, vacuum, draft of water, and all other circumstances being alike, the only difference being, the two-bladed narrow screw made six revolutions more per minute, which was partly, if not altogether, due to the diminished friction and increased speed of vessel, as compared with the three-bladed screw. Now, if the 9 in. surface on each of the two blades gave as much resistance to the power exerted, as was offered by the 3 ft. 4 in. on each of the three blades, what could the extra surface on these blades be doing?

There is also another very interesting fact proved at the *Flying Fish* trials, that considerably more resistance is offered by the water to the blades of the screw, when set at an incline towards the ship, instead of being at right angles with the screw shaft. The screw I made for the *Flying Fish* had two sets of blades made for it, the one set being at right angles with the shaft in the ordinary way, the other fixed at an angle of about 18° towards the ship, and with these blades at 16 ft. pitch, held the engines at 77·3 revolutions, Ind. H. P. 1·265, and with the blades set at right angles with the shaft; they required to be 20 ft. 6¼ ins. pitch, the engines making 75½ revolutions and 1281·8 Ind. H. P., the result in speed being slightly in favor of the straight blades. I shall here draw your attention to the fallacy engineers have fallen into regarding the slip, as it is termed, of the screw; for in this case one screw had 4·146 ft. more slip in every revolution than the other, and yet gave a better result in propelling the vessel in proportion to the power exerted; the fact being, that whether the vessel is moored or under weigh, the slip (or what is more properly termed the water which is forced through the screw) is the same, and must be in proportion to the power exerted.

I will give you, *per contra*, another instance of the effect the pitch of a screw has with regard to the speed obtained relative to the power employed.

In January last I had a letter from Mr. Frederick Bramwell, of Bridge Street, Engineer, giving me the result of a trial he had just made with one of my screws on the steamship *Augusta*, of 60 H. P., into which he had been putting new boilers, and doing other repairs. The owners were desirous to increase the pitch of the screw, as they were under the impression it would improve the speed. The screw was 5 ft. 6 ins. diameter, and Mr. Bramwell had it set at 11 ft. 3 ins. pitch at the points of blade, and when tried at her moorings the engines made 116 revolutions per minute, but when under weigh they only made 110, and when tried at the measured mile at Long Reach, with 110 revolutions, the ship gave a mean speed of 6·385 knots. Mr. Bramwell from prior experiments he had on other vessels with my screw, could perceive from the wake-water the screw was not doing its duty; he therefore had the vessel run on the beach, and altered the pitch to 10 ft. 3 ins. at points of blade, and then went again on the measured mile. The engine again made 110 revolutions, steam and vacuum the same as first trial; but the ship now gave a mean of 7·9 knots; and, as Mr. Bramwell observed, had the screw been cast in one piece, it is probable the owners would not have allowed the ship to be detained to get another screw cast, and the vessel might have worked for years at a loss of 1½ knots in her speed, wasting fuel, oil, &c., to no purpose.

Experience has taught engineers what pitch to put on a screw so as to hold the engines at very near the required speed; but they have not yet learned how to fix upon the best pitch that will give the best result in propelling the ship, relative to the power exerted, any more than has the ship builder in giving the best form to the vessel, for obtaining the greatest speed relative to the power applied.

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*On the Circumstances which appear to limit the maintenance of Higher Speeds than are now attained by Steamships in Deep Sea Navigation, and an Inquiry into the Causes which have hitherto prevented the asserted High Speeds of Steam Navigation on the American Rivers from being arrived at in England.** By Mr. R. Armstrong.

In the explanation of the above circumstances, the first application of the established principles of science is of absolute importance. When those principles are clearly proved to be at fault, then it will be time to assert that the science of naval architecture receives no assistance in the "why and the wherefore" for the formation of vessels; but until then the safest calculations are those made on the firmly-established principles of mechanics and hydrostatics. By merely accepting those principles, we reduce the whole art of naval construction, and an answer to that most important subject to a simple mathematical calculation; and what is of the most primary importance, the separation of the performances of the machinery from the question of the form in the calculations of velocity.

The science of mechanics asserts that with a given power the velocity is in proportion to the weight to be removed—the less the weight the greater the velocity of that power; it asserts that the inclined plane cannot decrease the weight, and it most emphatically asserts that the theory of the wave—convex, concave, or any other form of water line—for producing less resistance to a vessel passing through the water, is the grossest delusion of the nineteenth century.

The science of hydrostatics asserts that the resistance is as the square of the velocity—the propelling power to overcome that resistance the same—and not as the cube, which is the prevailing opinion at present with respect to steam navigation.

In seconding these assertions of science, every available data shall be produced in preference to arguments to establish the value of the following formula for every requirement, for any rate of sailing, they are based on the fundamental law of hydrodynamics for calculating the resistance of a fluid, namely:— Force = area × density × velocity squared; and of mechanics, that a machine can never diminish the total expenditure of power necessary to overcome any resistance, and the great desiderata of naval architecture.

$$V^2 \text{ miles} = \frac{\frac{2}{3} \text{ Ind. H. P.} \times 100}{\text{Mid. Sec.}}$$

$$\text{Mid. Sec.} = \frac{\frac{2}{3} \text{ Ind. H. P.} \times 100}{V^2 \text{ miles.}}$$

$$\frac{2}{3} \text{ Ind. H. P.} = \frac{\text{Mid. Sec.} \times V^2 \text{ miles}}{100}$$

* From the Lond. Artizan, April, 1857.

In basing calculations upon these formulæ, the expression Mid. Sec. is the greatest section to the line of motion, and the reason for adopting two-thirds of the Ind. H. P. is its effective value to the length of a statute mile, the truth of which will appear in its application to the tabulated list of screw steamers. Now if any form presents less resistance than another, here is a common standard to exhibit its excellence for velocity, and the best means of testing the relative efficiency of the screw propeller and paddle-wheel when applied to vessels of any form, tonnage, and steam power.

In the following table the vessels are tabulated according to the degrees of efficiency for speed above or below the rate deduced from the formula, commencing with the highest; it will be observed that out of the twenty-nine vessels, sixteen are within 10 per cent. of the velocity given by the above formula.

Name.	Displacement to one No. H. P.	Mid. Sec.	Ind. H. P.	Actual Speed.	Speed per Formula.	Ratio of Speeds.	Pitch to Diameter.	Revolutions per Minute.	Engineers.
Plumper,	9	201	148	8·47	7·00	1·21	·62	115	Miller.
Reynard,	10	184	165	9·43	7·74	1·21	·91	108	Rennie.
Archer,	6	372	345	8·93	7·87	1·13	·86	108	Miller.
Arrogant,	7	580	623	9·48	8·40	1·12	·96	55	Penn.
Rattler,	5	274	428	11·5	10·20	1·12	1·10	104	Maudslay.
Rifleman, dimin.	5	175	188	9·15	8·18	1·08	1·12	110	Miller.
Niger,	3	403	828	11·70	10·81	1·08	1·36	68	Maudslay.
L'Alma,	6	509	1263	13·7	12·85	1·06	1·33	57	Humphrys.
Candia,	5·5	532	1356	13·7	13·04	1·05	1·28	66	Rennie.
Ava,	—	372	960	13·83	13·12	1·05	—	—	Todd.
Aden,	5	302	900	14·6	14·07	1·03	—	—	Summer.
Vulcan,	5	465	793	10·97	10·68	1·02	1·18	66	Rennie.
Minx, diminished,	20	82	32	5·15	5·09	1·01	·73	140	Seaward.
Encounter,	3	318	672	11·83	11·72	1·01	1·25	78	Penn.
Sharpshooter,	2·5	192	365	11·17	11·27	·99	1·12	140	Miller.
Himalaya,	4·5	560	2050	15·85	15·75	·100	1·55	59	Penn.
Ajax,	7	807	846	8·168	8·36	·97	1·12	48	Maudslay.
Dauntless,	4	522	1218	11·76	12·15	·91	1·22	68	Napier.
Phœnix,	5	347	382	8·11	8·51	·91	1·05	68	Penn.
Conflict,	3·5	402	777	10·616	11·31	·93	1·22	68	Seaward.
Amphion,	6·5	516	592	7·71	8·48	·90	1·4	45	Miller.
Fairy,	1½	72	364	15·227	17·2	·88	1·5	258	Penn.
Termagant,	4	587	1351	10·46	12·37	·84	1·16	66	Seaward.
Blenheim,	6	738	938	6·646	8·00	·83	1·25	43	Seaward.
Rifleman,	2	173	342	9·24	11·58	·80	1·12	119	Miller.
Teazer, diminished	5	83	128	8·77	10·15	·86	1·40	192	Penn.
Minx,	2	82	234	10·43	13·79	·75	1·11	254	Miller.
Dwarf,	1·1	66	216	12·01	14·76	·89	1·41	182	Rennie.
Teazer,	2	83	175	7·2	11·83	·63	1·29	200	Miller.

Before making the necessary conclusions upon the value of the proposed formula, it will be necessary to test a few of these examples, on the principle that the resistance varies as the cube of the velocity; the formula would stand thus

$$V^3 = \frac{\frac{2}{3}\text{ Ind. H. P.} \times 1000}{\text{Mid. Sec.}}.$$

Name.	Actual Speed.	Speed by V^3 Formula.	Speed by V^2 Formula.
Minx, diminished,	5·15	6·34	5·09
Himalaya, - -	15·85	13·46	15·75
Archer, - - -	8·93	8·51	7·87
Dauntless, - -	11·76	11·58	12·45
Vulcan, - - -	10·97	10·12	10·68
Fairy, - - -	15·22	15·00	17·20
Plumper, - -	8·47	7·88	7·00

However adverse these examples may be to the resistance varying as the square of the velocity, they prove incontestibly the value of the midship section theory for calculating the velocity of steam vessels. It is only by the greatest extremes—the *Minx* and *Himalaya*—that the truth will be elucidated, because the formulæ are based on the fact that 1 effective H. P. is required for one square foot of midship section to produce a velocity of 10 miles per hour; consequently, it is at this velocity which so many vessels approximate to, that has led to the adoption of the cube theory as the measure of the resistances. The following computation of the amount of H. P. for 100 sq. ft. of midship section for every mile will best illustrate the two principles:—

H. P. for V^3.	H. P. for V^2.	Mid. Sec.	Rate, Miles.
·1	1	100	1
·8	4	100	2
2·7	9	100	3
6·4	16	100	4
12·5	25	100	5
21·6	36	100	6
34·3	49	100	7
51·2	64	100	8
72·9	81	100	9
100·0	100	100	10
133·1	121	100	11
172·8	144	100	12
219·7	169	100	13
274·4	196	100	14
337·5	225	100	15
409·6	256	100	16
491·3	289	100	17
583·2	324	100	18
685·9	361	100	19
800·0	400	100	20

It is now necessary to point out that the midship section given in the data, more especially in screw steamers, is not the greatest section to the line of motion; that at the higher velocities (say 13 miles), the normal immersion of the after end of the vessel increases in a rapid proportion,

still further increasing the section to the line of motion, on which the calculations for velocity are made; that a variation from the rule may arise from the imperfections of the engine—the form of the propeller—the after end of the vessel, and more especially from the propeller not being properly immersed; these well known causes are a sufficient explanation for the deviation.

To proceed with the arguments, the *Minx* and *Himalaya*, as the two extremes, are proof that the square theory is correct, the Ind. H. P. in both vessels to Nominal H. P. being nearly 3 to 1.

The *Archer*, a fine pitch screw, well immersed, and the Ind. H. P. to Nominal H. P. being only $1\frac{1}{2}$ to 1 is a sufficient explanation for the deviation from the rule.

The *Dauntless* and *Vulcan* require no comment.

The *Fairy* now demands an explanation :—

1st. The Ind. H. P. to Nominal H. P. is nearly 3 to 1, the diameter of the screw 5 ft. 4 ins., mean draft of water, 4 ft. 10 ins., therefore not immersed.

2d. The ratio of the diameter to pitch 1·5. Now, as the coarse pitched screws are all on the negative side of the formulæ, a deviation from the rule may arise from that source. [Query, would not the angle from the axis of the screw be a better expression for the pitch ?]

3d. As a screw vessel, with only 168 tons displacement and 128 Nominal H. P., the vessel would be considerably by the stern, possibly 18 ins., which again would be considerably increased by the normal immersion of the after end of the vessel at 15·22 miles per hour, consequently the greatest section to the line of motion might be safely estimated at 93 (the midship section given 72 sq. ft.), the rate by the formula for the 93 ft. section would be 16 miles per hour, and for the cube formula 13·77 miles per hour, which, taken in connexion with the other mentioned reasons for deviation, proving the square theory correct.

Lastly, the *Plumper* is a beautiful illustration of the best conditions required in the screw as a propeller: in fact these arguments may be applied as the reason of the deviation from the rule in the whole of the twenty-nine tabulated screw steamers.

As an additional proof of the square theory being correct, an extract from the Report of the Trials of the *Charlemagne* (the usual system in the French Navy, which, if introduced into this country, would soon reduce naval architecture to an exact science), shall now be produced. With two boilers 3064 lbs., three boilers 2659 lbs. of coal was required to propel the vessel 8 miles per hour; with four boilers, 5733 lbs. per hour propelled the vessel 10·9 miles per hour; therefore,

lbs. of Coal.								Actual.
8^2	:	3064	: :	$10{\cdot}9^2$	:	5688	.	5733
8^2	:	2659	: :	$10{\cdot}9^2$	:	4936	.	5733
		or						
8^3	:	3064	: :	$10{\cdot}9^3$	:	7749	.	5733
8^3	:	2659	: :	$10{\cdot}9^3$	:	6744	.	5733

At the 8 miles the mid. section was 958·54, and at the 10·9 miles 953·19 sq. ft.: so that the necessary conditions for a comparison are

nearly equal, consequently again proving the square theory correct and the cube theory false, and economy in the consumption of coal by increased boiler space at the rate of 4 tons per day.

In sea-going steamships 5 lbs. of coal taken as the consumption of one effective H. P. will be found most valuable for every required calculation for velocity.

To return to the tabulated list of screw steamers, the following most important conclusions are confirmed:—

1st. That in the separation of the performances of the machinery from the question of the form in calculations of velocity, the duty of naval architecture is merely to provide the requisite displacement that the vessel may float at the agreed upon immersed midship section, the stability, strength, and other properties required in a vessel; all considerations for velocity being the province of the engineer.

2d. That the rate of sailing between two vessels with an equal moving power in each does not depend on the form of water-line, but entirely on the area of the greatest section to the line of motion.

3d. That displacement in the line of direction does not materially add to the resistance.

4th. And (what is the most surprising) that the friction between the sides of the vessel and the water need not enter into any calculation for any required velocity.

The first axiom is proved by the whole list of vessels. The second is triumphantly established by the same formula producing the velocity of the *Ajax* and *Himalaya*, two vessels of the most opposite type: in fact, it is completely established by every vessel produced in the list. The third and fourth by the longest and largest vessels, being at or on the positive side of the speed deduced by the formula, the exception being the *Amphion*, *Termagant*, and *Blenheim*, the former vessel can be safely attributed to the propeller, the two latter most decidedly to the engines; in fact, Seaward's engines are all on the negative side of the speed deduced by the formula.

It only remains for me to assert that the requisite conditions are not fulfilled, "for the maintenance of higher speeds than are attained by steamships in deep sea navigation."

In the application of these principles for the attaiment of higher velocities, and to render ocean steam navigation remunerative without Government assistance, *length* is the only alternative; and, as an illustration of its advantages, the *Himalaya* shall be taken as a basis for the necessary calculation, and the length of the voyage, 3240 miles—Liverpool to New York.

Length, . . .	340 feet.
Breadth, . .	46 "
Mid. section, . .	560 sq. ft.
Displacement, . .	3220 tons.
Nominal H. P., . .	700
Consumption of Coal, .	80 tons per day.

The fact that the velocity by the formula was maintained between the *Fairy* and *Himalaya*, although nearly of three times the length, twenty times the displacement with only five and a half times the power; prov-

ing conclusively the 200 feet additional length (doubling the displacement), the same velocity would be maintained; therefore space for 2000 tons of cargo would be obtained; an ample remuneration for the additional size of the vessel; but if velocity was the object by doubling the nominal H. P., a speed of 22 miles per hour would be obtained with only an increase in the consumption of coal of 300 tons, still leaving space for 1000 tons of cargo with the same immersed midship section; it may be asserted that the velocity assigned to the *Himalaya* was only obtained at the trial of a single mile; but, by increased boiler space, say 50 per cent., that velocity could be maintained for the length of the voyage.

Then, again, by lengthening the vessel in midships an additional 200 feet, the displacement would be increased three times, and with three times the power, which would only maintain the original proportions of power to displacement, a velocity of 27 miles per hour would be obtained, or Liverpool to New York in five days. The dimensions then would be—

Length, . . .	740 feet.
Breadth, . .	46 "
Mean draft of water, . .	$16\frac{3}{8}$ "
Midship section, . .	560 sq. ft.
Displacement, . .	9660 tons.
Nominal H. P., . .	2100
Consumption of coal, . .	240 tons per day.

With these proportions of the vessel we have only arrived at the same ratio of dimensions of the *New World*, one of the most modern vessels of the American rivers, the square root of the immersed midship section to length being as one to 27; in the lengthened *Himalaya* 1 to 31. Assuming the velocity of the *New World* at 20 miles per hour, and the immersed midship section (normal immersion of the after-end included) 210 sq. ft., the Ind. H. P. by the square formula $\frac{2}{3}$ Ind. H. P.

$$= \frac{\text{Mid. Sec.} \times V^2}{100}$$ would be 1260, and by the cube formula

$$\tfrac{2}{3}\ \text{Ind. H. P.} = \frac{\text{Mid. Sec.} \times V^3}{1000}\ 2520\ \text{Ind. H. P.}$$

As engineers, I ask, is it possible for one cylinder of the cubic contents (of a double stroke), 1203 cubic ft., to develop 2520 Ind. H. P., while one cylinder of the *Atrato* cubic contents for a double stroke, 903 feet, with the same number of revolutions, only developed 1635 Ind. H. P. at a trial at the measured mile, while the former is calculated for continuous steaming?

Again, assuming the consumption of coal at 3 tons per hour (about the same as the *Himalaya*), with the contrivances for increasing the combustion, 6 lbs. of coal is a very moderate calculation for 1 effective H. P.; consequently, the amount of that power would be 1120, which approximates nearer to the square than the cube theory.

N. B.—It is the want of reliable data that compels me to use this form of argument.

These assumptions, which are based on the highest degrees of pro-

bability completely proving that the asserted high velocities of the American steamers are only based upon the unerring laws of mechanics and hydrostatics, I can now, with the greatest confidence, challenge the naval architects of this country to bring forward their data to prove the slightest claim to any increase of speed by their nostrums, or to point out where great speed is obtained that it is not always on the side of the small midship section and increased steam power above the ordinary proportion of other steamships; by so doing, they will remove the imputation of having practised the most arrant quackery and the greatest imposition upon that age that boasts of the electric telegraph, the railway, and the mighty improvements in every other mechanical art.

It will now become the duty of the engineers of this country to assert their right to all credit for every fraction of the increase in the velocity of steamships—to assert their independence of the naval architect in all questions of velocity—to assert that the increased effective power of their engines have been completely neutralized by the theory of the sharp water-line, to assist me with all data (Mid. Sec. Ind. H. P. and consumption of coal) to combat that delusion so as to enable me to perfect the "Arithmetic of Naval Architecture" (published in *The Artizan*), which triumphantly illustrates the increased effective power of the more modern engines; it exhibits a system by which the economy of the engines can be calculated, and their claim to be considered the producers of that velocity unjustly claimed by the Naval Architect.

To the steamship owner, the advantages of bringing the science of naval architecture within the range of arithmetical calculation is of the most paramount importance. The facts elicited in the tabulated list of screw steamships point conclusively to the desiderata by which ocean steam navigation, at high velocities, may be made remunerative without Government assistance. As examples, take the *Dauntless* and *Dwarf*, the velocity of each is 12 miles per hour; in the former the displacement to Nominal H.P. is as 4 to 1, while in the latter it is as 1·1 to 1.

In the—

Archer,	6 tons to 1	Nom.	H. P.
Arrogant,	7	"	"
Minx,	20	"	"
Fairy,	$1\frac{1}{4}$	"	"
Niger,	$3\frac{1}{2}$	"	"
Plumper,	9	"	"
Reynard,	10	"	"
Teazer,	2	"	"
Rattler,	5	"	"
Rifleman,	5	"	"
Himalaya,	$4\frac{1}{2}$	"	"
Vulcan,	6	"	"

Here is the fact, substantiated by data, that has the authority of the Admiralty for its correctness, that the four vessels that have the largest ratio between the displacement and nominal H. P. are the most efficient for speed; proving conclusively that the Midship Section and not weight, is the sole basis for calculations of velocity.

As another illustration, the ratio of the displacement to the immersed Midship Section shall be given in the following vessels, viz:—

Fairy,	$2\frac{3}{4}$	tons to 1 sq. ft.
Minx,	$2\frac{1}{2}$	"
Dwarf,	$2\frac{1}{4}$	"
Teazer,	$2\frac{1}{2}$	"
Arrogant,	4	"
Dauntless,	4	"
Aden,	4	"
L'Alma,	5	"
Candia,	5	"
Himalaya,	6	"

Here, again, is the fact that the vessels with the largest displacement to the midship section is a positive advantage to velocity, and the proof that displacement or surface in the line of direction does not increase the resistance or friction.

Let me illustrate these facts by the most powerful of arguments, £. s. d. By the *Himalaya* lengthened in midships until the displacement to nominal H. P. is the same as the *Reynard*, 10 to 1, these illustrations prove conclusively that 3000 tons of dead weight, with a clean bottom, could be carried from Liverpool to New York at the same expense of engine and coals, as at present, which, taken for the voyage out and home again, exclusive of passengers, would produce, at £3 per ton, £18,000, or, for nine voyages per year, £162,000, a sum amply sufficient, without assistance from any government, to remunerate the outlay for the increased tonnage of the vessel.

But the best proof that these views are correct will be established by what will be termed in after ages the greatest monument of the most stupendous delusion ever imposed upon this most practical age. The *Great Eastern*, with every confidence in the correctness of these formulæ for every requirement that I venture to predict, that this vessel—displacement to nominal H. P., 7 to 1; displacement to midship section, 11 to 1 (nearly twice that of the *Himalaya*,) and at an immersed midship section of 1600 sq. ft.—will be propelled at the rate of 18 miles per hour, provided the engines work up to the same proportionate indicated H. P. as the *Himalaya*. Can the most far-seeing imagine the immense results to be obtained by the complete establishment of the fact that 10 tons can be propelled by increased length at the same cost and rate as the $4\frac{1}{2}$ tons in the *Himalaya*?

Such are the advantages to be gained by increased length, but, with the present system in the construction of vessels, we are at its limits; but are these profitable results to British enterprise to be lost, with such an example as the Britannia Tubular Bridge, asserting that vessels twice or three times the length of the present dimensions can be constructed of sufficient strength to sustain their weight in whatever situation they may be placed in? Even now it is possible to point out numerous vessels building exactly on the same principle which has been found to want strengthening after two or three voyages.

Again, it is easy to point out vessels that retain the same sectional form, ends, and water-lines, as the *Ripon*, *Indus*, *Pottinger*, and *Haddington*, that wanted the elements of stability; that in deviating from their course, at least 15 per cent. of their power was consumed by not sailing in a direct course; and it can safely be asserted that the means used to remedy that deviation were insufficient for the purpose—in fact,

the whole practice of naval architecture, both in the construction and formation of vessels, is a disgrace to the nineteenth century, and demands an immediate reconstruction.

To the capitalist the building of vessels by the facts here established will become the most profitable investment of capital of the day; it is the only mechanical art that remains for the application of machinery, the division of labor, and other appliances (detailed in "The Causes and Remedy of the Unprofitable State of Shipbuilding") that has increased the manufacture of this country to its present enormous extent; by the fact that the midship section is the sole basis for calculations of velocity. The best form of water-line can soon be decided. The stability and the other requisite conditions in the form of vessels can be established by the experiments of Attwood and other celebrities, whose experience has been lost to the present generation. Therefore, with a form of vessel (length in midships being the only improvement) firmly established, the application of machinery to each part of a vessel can be most profitably employed, without the risk of that continual change in the form of vessels that has existed during the last twenty-five years, which is only another proof of the absence of any established principles in naval architecture.

In conclusion, to every one interested in our naval and mercantile supremacy, and the progress of civilization, this subject is deserving of the most serious consideration. Let me point to the great progress in steam navigation during the last twenty years. Now, if that progress has been made upon a false theory, how much more rapid will the advance be when based upon a true principle? The present progress will dwindle into comparative insignificance when compared with the mighty results depending upon the establishment of the fact, that 10 tons, or even 20 tons, can be carried with the same amount of engine power as 1 ton. The only question remaining to be solved, is to what extent can the displacement in the line of direction be carried without affecting the speed deduced by the formula? With Australia reached in twenty-five days, New York in six, and the last remnant of protection (subsidies to steamship companies) proved to have been the greatest curse to the advancement of steam transport economy, in leading to the belief that high velocities were not possible to be remunerative without that assistance; when these are accomplished facts, then, indeed, we may boast of the progress of naval architecture.

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*On the Varieties of Permanent Way, practically in use on Railways.** By W. Bridges Adams.

[Read at a Meeting of the Institution of Civil Engineers, Feb. 3d, 1857.]

The Paper commenced by stating, that the calculations of Engineers, as to the strength and duration of "permanent way," had been baffled by the unforeseen increase of traffic, and that the proportions of the road to the heavy engines required to be reconsidered. It then described the principles involved—lateral and vertical strength of rails and firm joints,

* From the Lond. Civ. Eng. and Arch's. Jour., March, 1857.

—ample bearing surface of the rails on the sleepers, and of the sleepers on the ballast,—chemical durability of the materials,—the porous ballast for drainage,—and the buoyant principle for boggy ground.

The importance of the depth of the rail, to prevent too great flexure under the rolling load, was then dwelt on, combined with the principle of supporting the rail, by the upper portion, as closely as possible to the surface, to prevent displacement.

The chronological sequence of the various forms of rails, was the single T, the double T, the bridge, and the contractor's rail; then the chair serving as an extended base to keep the rail from tilting sideways.

The process of fish-jointing was then considered, with regard to its effect in converting each rail into "a beam fixed at the two ends," and thus practically adding to the vertical strength. It was shown, that the strongest form of the double-headed rail, in which the shoulders formed an obtuse angle with the vertical web, was the worst form for fishing, and that the fishes were only kept tight by an intense strain on the bolts, which commonly worked loose, so that if neglected, the suspended fish joint was less perfect than an ordinary joint chair. The practice of rolling rails with squared side channels, to get better hold on the rails, was a great evil, for the edges were thus exposed to be sheared off by the action of the engine wheels. A remedy for this was shown to be practically, by stamping the ends of the rails, whilst hot, in dies, so as to square the channels to the length of the fishes, and thus to compress the metal in the heads, and to prove its quality at that part where it was usually the least sound. Thus the seats for the fishes would be square indents and fac-similes. An improvement in the form of the fish itself was to roll it as an angle iron, with a horizontal rib below, which, while adding to the horizontal strength, afforded the means of securing a lighter class of bolts from getting loose, by keying them between the rails and the beveled sides of the nuts and bolt heads. A mode of keying ordinary fish bolts was also shown, by driving thin plate wedges between the beveled edges of adjoining bolts. A description followed of various other joints: Mr. Fowler's three wedge chair: Mr. Samuel's fish chair: Mr. P. W. Barlow's double chair, bolted below the rail; Mr. M'Conochie's wedge chair; Mr. Mansel's wood pile chair; Mr. Adams' bracket, or knee joint and intermediate fastenings used on the Great Northern and South Western lines, applicable equally to the double headed, and to the foot or contractor's rail; Mr. W. H. Barlow's double wedge key chairs; Mr. Parsons' fish key and wood lined joint chair; Mr. Burleigh's joint chair and long key, without wood lining; Mr. Wright's vice-joint chair; and Mr. Barningham's long double chair on two sleepers. Split rails, in two parts, breaking joint longitudinally, were then described, and also a system of wooden chairs and struts used in France.

The fishing and jointing of foot and bridge rails were then treated seriatim, and the truss joint for bridge rails, concluding the series, was described. Then followed the series of iron sleeper way,—Mr. Reynold's "hog trough metals," Mr. Greaves' spheroidal sleepers, Mr. P. W. Barlow's cast iron way, Mr. Samuel's wood lined cast iron sleepers, and Mr. De Bergue's cast iron sleepers.

Wrought iron way and sleepers, without timber, were then examined, beginning with Mr. G. W. Buck, in 1845, who produced a plan very similar to that introduced by Mr. W. H. Barlow, in 1849, the various sections of which were criticised. Then followed the girder rail, first propounded by Mr. Adams, in 1851, and now modified and successfully tested and extending in use. A sample of this rail 7 inches in vertical depth was shown, with angle brackets spreading to a width of 13 inches, breaking joints, and bolted beneath the horizontal webs. Plans of the same kind were also exhibited, applicable to the ordinary double T rail; a rail of 65 lbs. and a bracket of 28 lbs., with bolts bearing on shoes or on external edges, the bearing surface on the ballast being equal to a cross sleeper road with the sleepers at intervals of 3 feet. These wrought iron girder rails were, practically, beams; but were sufficiently elastic to prevent destruction by blows—a quality always insisted on by Mr. Robert Stephenson. Experimental results were given; and a description of Mr. Spencer's corrugated permanent way, completed the series.

Sixteen diagrams of varieties of permanent way, beginning with the stone-block system and ending with the girder rail, were exhibited, showing the various heights above the bearing surface on the ballast, from 18 inches down to 2½ inches.

Specimens were shown of Mr. Adams' double-headed girder rail, as used on the Great Northern Railway; of the bridge and truss joint, as used on the Great Northern and Western of Ireland, the Belfast and Ballymena, The South Coast, The South Western, and other railways; the bracket joint, as used on the Great Northern and South Western; and models of the bracket joint and intermediate brackets with two bolts; and of the mode of keying fish bolts.

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On some Recent Improvements in the Permanent Way of Railways. Read at the same Meeting. By P. M. Parsons, Assoc. Inst. C. E.

The improvements described in this Paper had reference particularly to the form of the chair, and to the nature of the fastenings. As laid on the East Kent Railway, the joint chairs weighed about 54 lbs. each, and with the exception of being somewhat longer, were in general appearance similar to ordinary chairs. They were 12 inches in length, and the sole or bottom, was provided at the underside with a cross rib at each end, overhanging the sleeper on each side, and forming with it an inverted trough girder, of which the ribs were the webs, and the sole or bottom of the chair was the flanch. One jaw of the chair was made to fit the shoulders of the rails, and the other was provided with two recesses, which received two thin creosoted elm blocks, cut across the grain, acting as cushions,—a wrought iron wedge, provided with jags, or barbs, being driven between the rails and the wooden cushions. In the intermediate chairs, one jaw was of such a form that the upper part pressed against the web, and the lower part against the side of the table. The other jaw had an inward inclination of about one in three, and was provided with a dove-tail recess, to hold the wooden cushion,—a cast iron wedge being introduced between it and the rail. This wedge, instead of fitting against both shoulders of the rail, was made to bear against the web and the upper part of its lower shoulder, by which the rail was forced down upon the seat, and was held firmly in a lateral direction.

A short length of way on this system was laid in 1854, on the Great Northern Railway, under the direction of the Engineer in Chief, Mr. Cubitt, and the results were considered to be very satisfactory.

Specimens of these chairs and fastenings were exhibited, and the subject was generally fully illustrated by a large series of models furnished by the Permanent Way Company.

Discussion upon the "Permanent Way of Railways," at the meetings of Feb. 10 *and* 17. It was remarked that the Paper omitted all notice of the class of fastenings employed previous to the introduction of the wooden key. This class consisted either of iron pins, small iron wedges, or screw bolts, all embodying the same principle of small metal surfaces bearing upon small points of contact. The fit was generally very imperfect, and the fastenings rapidly deteriorated. When, from any irregularity of fit, an undue strain came upon the bolt, the thread of the screw was stripped, or the nut took a particular set, to which it always returned when screwed up. These fastenings were abandoned simultaneously by all Engineers in favor of the wooden key, which presented an elastic medium to compensate for inaccuracies, and brought comparatively large surfaces into contact.

A recent examination of some brackets and fish plates, which had been laid down about twelve months, and were secured by bolts and nuts, showed that in 125 pairs of joints, each pair having 8 bolts, 261 bolts were loose, and 6 were out altogether, though they had been tightened up within 48 hours. The number of loose bolts at each joint varied from 1 to 8. It was contended, therefore, that bolts and nuts, such as were originally used, were unsafe, inefficient, and expensive fastenings, for connecting together the parts of a permanent way, and that they were not to be relied on.

It was argued that a simpler system for binding the different parts together, was to employ wedges, which were always capable of performing their office, and were tightened up by a blow of a hammer.

With regard to the "girder" rail, it was contended, that experience had proved its rigidity and want of elasticity to be so great, that the heavy weights now carried on railways would soon destroy its upper surface, and cause it to laminate. The effect, too, of reducing the thickness of the middle web, would be to increase the cost of the rails per ton—and though credit had been taken for a saving in the item of ballast on this system, it was thought that Engineers generally would not like to diminish the amount of ballast on a railway.

It was observed, that an essential principle in a permanent way, was to form the various lengths of rails into continuous bars, by fixing them firmly at their ends, either by chairs, or brackets, or fishes, (keyed, or bolted,) or by break-joint angle plates. With a view to prevent the bolts from getting loose, a system had been devised for locking both heads and nuts, so as to prevent them from turning round. This was proposed to be accomplished by beveling the edges of the bolts and nuts where in contact with the fishes, so as to form grooves in which to drive plate wedges between contiguous bolts, and then to fix them by turning up the corners. It was mentioned that the original "fish" was

keyed into the chairs and not bolted; and it was believed that this was firmer than the subsequent modification of the "fish-joint" with bolts, suspended between chairs. To compress the ends of the rails, and at the same time to form square channels for the fishes to lie at rest, without strain on the bolts, it was proposed to squeeze the ends of the rails whilst hot, between a pair of dies.

With reference to the comparative weights of the cast iron sleepers used on the Londonderry and Enniskillen and the South Eastern Lines, it was stated that the lightest portion of the latter was 5 per cent. heavier than the heaviest portion of the Enniskillen permanent way, whilst the general average was 18 per cent. heavier. Altogether about 225 miles of these cast iron sleepers had been laid on different railways in England and Ireland during the last five years, and only about 1 per cent. per annum had required to be replaced from all causes. Experiments had recently been made to test the strength of different forms of cast iron sleepers, for which purpose a falling ram, weighing 12 cwt., was employed. Twenty-three forms were experimented upon, and the result was that an ordinary 80 lb. rail, with 3 feet bearings, was destroyed, by bending, with a fall of 2 feet, whilst the South Eastern sleeper bore a fall of 4 ft. 6 ins., being 1 foot more than any other which was tried.

A trial of a short length of De Bergue's cast iron sleeper way on the Great Northern Railway, was stated to have shown that the plate sleepers required a less amount of attention as to packing and lifting, than the ordinary transverse wood sleepers. The chief defect of this system was asserted to be the method of fixing the rail to the sleepers. It might possess some advantages of cost in some situations, and with some modifications would probably be made to answer well for light traffic. Adams' suspended girded rail had also been subject to a similar trial, and the result was, in some respects, very satisfactory. It was nearly equally rigid in all its parts, possessed a certain amount of elasticity derived from the wings, and but little vertical deflection. It presented great facilities for packing, and could be lifted in less than half the time required by the wood sleeper system. It might be advantageous for the future to increase the width of the tread of the rail.

It was stated, that there were now about 800 miles of single line laid with the Barlow rail, and that though in the first instance transverse wooden sleepers had been used, yet this method had now been abandoned, the rail being laid down without sleepers. The difficulties were the manufacture of a sound rail, and the rigidity of the way when made. The wrought iron way was more rigid than that of the cast iron. The rigidity of the latter might be overcome, it was believed, by the adoption of Samuel's trough sleeper with wooden fastenings. It was remarked that there were now more than 1000 miles of single line of iron permanent way laid and in operation. The practicability of the use of that material had, therefore, been proved, though, probably, the best form might not yet have been devised. It was considered singular that a country abounding in iron should annually expend hundreds of thousands of pounds in bringing timber from foreign countries, to lay and rot on the railways of the kingdom.

It was stated that a recent examination of some portions of the South

Western Railway, demonstrated the solidity of the permanent way laid with fish joints; very few, if any, of the bolts and nuts were loose, and the line generally was in a very good state. The same might be said of Samuel's fish chairs, and of Greaves' system, which had been so extensively and satisfactorily used on the Egyptian railways. Where bad bolts and nuts had been used they were loose and had caused much trouble, but if the company would permit a due expenditure, it was not at all difficult to make such a way as would be really permanent; indeed, as was subsequently remarked, wherever good materials of sufficient weight and well put together, were employed, it was difficult to make a bad permanent way. Nothing but undue economy induced such a result. The compressed wooden keys were first tried on the Liverpool and Manchester Railway in 1835, and the improvements in their manufacture introduced by Messrs. Ransome and May, had materially extended their use. The double-headed rail was first rolled under the direction and from the designs of Mr. Locke, and it was asserted, in contradiction of some statements relative to their not being reversed, that there were few, if any, rails of that description finally rejected as being worn out before they had been reversed in the chairs. As to the assumed rigidity of cast iron permanent way, it was shown, that the specimens of Greaves' and of De Bergue's iron way, demonstrated the fallacy of such an assumption, as they were both found to be, after many years hard usage, in an excellent state of preservation, and had not produced any injurious effects on the rolling stock.

It was admitted, that in many of the experiments on fishing joints, indifferent materials had been used and with corresponding results; they had been first adapted to railways in a bad condition, where the ends of the rails were injured, and the fishes did not fit; the pins were thus broken and the results were disastrous; but when they had been adapted to new or uninjured rails, the results were invariably good.

It was objected to the Paper, that it had overlooked many of the most salient improvements, such as the bridge rail, and Ransom's and May's cast iron chairs, which latter were, with the compressed keys and trenails, now used on nearly six thousand miles of single line of permanent way. Also, that the Barlow rails did not, as had been asserted, suck up the water beneath them; but that the ballast, when duly packed, was solid and remained for a long period without failing.

The compressed wood trenails and keys, with cast iron chairs of uniform construction and good form, and a rail not exceeding 82 lbs. per yard, fixed at the joints, made a very firm and good way.

It was asserted with respect to the fish joint, that Mr. Richardson was the real inventor,* he being at the time an assistant engineer on the Eastern Union Railway, where the fishes were first used by Mr. Bruff to tie together and stiffen the ends of the rails, and render them, in fact, a girder across a weak bridge on that line. To this it was replied, that Mr. Richardson's first idea was not a fished joint at all, but merely a scarfed joint rail, which was not adopted, because it was not considered

* The "*fish joint*" as now used, appears to be an American invention. The inventor, R. H. Barr, of New Castle, Delaware, having made and deposited, in 1843, in the Franklin Institute of Philadelphia, a model of "*fish joints*" as now used.—Com. Pub.

effective. Mr. Adams then produced a joint having the same object as the operation of fishing a spar, an operation so well known to seamen; it was patented in the names of Adams and Richardson, the former gentleman drawing the specification and making the models at his works, where they were seen and approved of by Mr. Peter Ashcroft, before the period of the competition for the prize, offered by the Eastern Counties Railway Company, for an effectual method of securing the joints of rails. This was believed to be the correct version of the invention of the fished joint. It was at the same time stated, that upwards of twenty years ago, several hundred tons of these fishes had been rolled, and been exported from Liverpool, by Mr. Edwin Mawe, to* America and to Germany, and that there was not any novelty in their subsequent introduction on the English railways.

It was urged, that the method of depreciating all previous systems for the purpose of advocating a new introduction, was unwise. The Engineers would judge for themselves as to the merits of new inventions, and were much better able to judge of them than the inventors themselves. It was very prejudicial to the profession, that Engineers, having the control of railways, should become patentees, and band themselves together for the purchase of other inventions to be used on the lines upon which any of them were employed; it laid them open to suspicions to which professional men should not be subjected, and gave a color to the statements that contractors were obliged to pay for the use of these patents, in order to prevent their tenders from being rejected, on other occasions, when submitted to engineers so placed.

It had been attempted to be shown, that it was advantageous for a company to become possessed of a number of patents, in order to facilitate dealing with them; but it was contended, that when there were numerous inventors whose claims were nearly balanced, it was more probable, that engineers would be able to arrive at equitable and reasonable arrangements for the use of the inventions, on better terms for the railway companies.

It was stated, that the permanent way adopted for the lines of railway in the East Indies, was of the simplest character, consisting of the ordinary double-headed rail, laid with chairs on transverse wood sleepers, and connected with fished joints; explanations were also given of certain points in the design and construction that had been carefully attended to, in order to ensure a successful result.

The fallacy of asserting, that a flat country admitted of the use of smaller engines and lighter permanent way, was demonstrated. The precautions necessary for constructing railways in Norway, Denmark, Canada, and all countries where the cold was intense, were explained, and it was shown, that the engineer must adapt the system of permanent way to the circumstances of the country and climate.

It was admitted, that it was desirable to separate as much as possible, the commercial from the technical questions, avoiding the former, in discussions at the Institution, but it was difficult at all times to do so.

In addition to the systems previously mentioned, specimens and drawings were exhibited of cast iron chairs used on the East Lancashire

* These were merely "*link plates*" not regular "*fish plates*.—Com. Pub.

Railway, by Mr. J. S. Perring; of Spencer's corrugated sleeper road; of a new rail by Mr. Bagot; and of a solid chilled crossing by Messrs. Ransome and Biddle.

For the Journal of the Franklin Institute.

New Formula for Computing the number of Balls in the Triangular, Square, and Oblong Piles. By Horatio Hubbell.

Computation of the Triangular Pile.

To compute the number of balls in this pile,

Let n represent the number of balls in the base row of the lower tier, then:

$$
\begin{array}{rl}
n+(n-1)+(n-2)+(n-3)+(n-4)+\ldots & (n-n)\text{ 1st tier.}\\
(n-1)+(n-2)+(n-3)+(n-4)+\ldots & (n-n)\text{ 2d tier.}\\
(n-2)+(n-3)+(n-4)+\ldots & (n-n)\text{ 3d tier.}\\
(n-3)+(n-4)+\ldots & (n-n)\text{ 4th tier.}\\
(n-4)+\ldots & (n-n)\text{ 5th tier.}\\
\text{Sum}\quad\ldots & (n-n)\text{ 6th tier.}\\
1\,n+2.(n-1)+3.(n-2)+4.(n-3)+5.(n-4)+\ldots & 0-0
\end{array}
$$

Suppose $n=5$, then the foregoing sum becomes,

$1{\cdot}5+2{\cdot}4+3{\cdot}3+4{\cdot}2+5{\cdot}1$, or there are two series, one the reverse of the other—multiplied together—with their products added,

$$
\begin{array}{r}
\text{thus, } 5+4+3+2+1\\
\text{Multiplied by } 1+2+3+4+5 \text{ member by member.}\\
\hline
\text{Products } 5+8+9+8+5=35.
\end{array}
$$

This I denominate a *symmetrical series.*

In these symmetrical series—when the series begins with an odd figure, (as the above) the differences are the odd numbers inferior to the first term—and the mean term is single.

When the series begins with an even number as 6, the differences are its inferior even numbers, and the mean term is duplicate.

It is evident, that in these series, it is only necessary to calculate the first moiety, and then duplicate, to have the sum of the whole series.

The general expression for that purpose whether with an odd or even figure is,

$n+(n+n-2)+(n+n-2+n-4)\ldots+(n-n+1\text{ or }2.$

This multiplied by 2 gives the whole series:

Ending 1 or 2 as the series begins with an odd or even figure.

(6.) Taking care, however, when it begins with an odd figure, *not to duplicate the last term*, otherwise it *must be again subtracted.*

The usual formula for the triangular pile is,

$$\frac{n\,(n+1)\,(n+2)}{6}.$$

Let $n=5$, then $2\left((5+(5+3)\right)+(5+3+1)=2.(13)+9=35.$

Let $n=6$, then $2\times\left[(6+6+4)+(6+4+2)\right]=2\times[16+12]=56.$

The above general formula $n+(n+n-2)+(n+n-2+n-4)+$ &c., p being=number of terms,

may be thus summed, $n\left(\frac{p(p+1)}{2}\right)-2\left[(1)+(1+2)+(1+2+3)\right]$ &c.

say there are four terms, $n\left(\frac{4\,(4+1)}{2}\right)-2\left[(4)+(6)\right]$

7 will run 4 terms as

$n+(n+n-2)+(n+n-2+n-4)+(n+n-2+n-4+n-6).$

Then let $n=7$ it is $7\times10-20=50$, which multiplied by $2=100$ minus the last term or $4\times7-(2+4+6)$ or $28-12$ or 16 from $100=84$ sum.

Computation of the Square Pyramidal Pile.

Let n be the number of balls in the outer row of the lower tier; then $n^2=n^2$ 1st tier.

2d tier, $(n-1)^2=n^2-2\,n+1.$
3d tier, $(n-2)^2=n^2-4\,n+4.$
4th tier, $(n-3)^2=n^2-6\,n+9.$
5th tier, $(n-4)^2=n^2-8\,n+16.$
× × × × × × × × ×
$(n-n)^0=0$

Assume $n=5$ the squares of $(1+2+3+4+\ .\ .\ n)$= whole number of balls or $(1+4+9+16+\ .\ .\ .\ n^2)$ which are the last terms of the above expansion of the first squares.

The first and second terms of the said expansion neutralizing each other thus:—

$n^2=25$	$n^2=25$	$n^2=25$	$n^2=25$
$-2\,n=10$	$-8\,n=40$	$-4\,n=20$	$-6\,n=30$
$+15$	-15	$+\ 5$	$-\ 5$

The analysis of the above squares $1+4+9+16+\ .\ .\ .\ n^2$ results thus:—

$$\left.\begin{array}{l}5\ n\\4\,(n-1)\\3\,(n-2)\\2\,(n-3)\\1\,(n-4)\end{array}\right\}\quad\text{or}\quad\begin{array}{l}5\,n\\4\,n-4\\3\,n-6\\2\,n-6\\1\,n-4\end{array}$$

The sum of which is making $n=5$,

$$5\left(\frac{5\times6}{2}\right)-2\,(4+6)=55.$$

And the general formula,

$$p \text{ being} = n-1 \text{ is } n\left(\frac{n\,(n+1)}{2}\right)-2\left[p+(p+p-2)\right].$$

or if $p=$an *odd number* it is :— $\left[2\,(p)+(p+p-2)\right]$. See (6) p. 20.

The usual formula by differences is,

$$\frac{n\,(n+1)\,(2\,n+1)}{6}.$$

Computation of the Oblong Pile.

To compute the number of balls in this pile,

Let $m=$the number of balls in the outer row of the bottom tier of the longest side.

Let $n=$the number of balls in the outer row of the bottom tier of the shortest side.

Put $n=5$ and multiply as indicated.

Then $m\times n=$ 1st tier.	$5\,m$.
$(m-1)\times(n-1)=$ 2d tier.	$4\,m-4$.
$(m-2)\times(n-2)=$ 3d tier.	$3\,m-6$.
$(m-3)\times(n-3)=$ 4th tier.	$2\,m-6$.
$(m-4)\times(n-4)=$ 5th tier.	$1\,m-4$.
××× ××× ×××	$15\times m-20=$ when $m=9$ to $135-20=115$
$(m-m)\times(n-n)=$ 000·	or $9(1+2+3+4+5)-(4+6+6+4)=115$

Let $p=n-1$.

The general formula is,

$$m\left(\frac{n\,(n+1)}{2}\right)-2\,(p+p+p-2) \text{ a symmetrical series,}$$

$$\text{or in numbers } 9\left(\frac{5\,(5+1)}{2}\right)-2\,(4+4+2).$$

The subtractive part *a symmetrical series*, or

$$15\times9-2\cdot10=115 \text{ amount of balls in pile.}$$

The usual formula by differences.

$$n\left(\frac{n+1}{2}\right)\left[\frac{m+2\,(m-1+n}{3}\right]$$

For the Journal of the Franklin Institute.

Practical Views on the Proposed Improvement of the Ohio River. By W. Milnor Roberts, Civil Engineer.

The Ohio River constitutes a part of the most extensive inland navigation known to the world; and if anything whatever in the interior can be so regarded, it is eminently national in its character. Eight States—New York, Pennsylvania, Virginia, Maryland, Ohio, Kentucky, Indiana, and Illinois, are watered by the Ohio and its tributaries; and eight more—Wisconsin, Iowa, Missouri, Tennessee, Arkansas, Alabama, Mississippi, and Lousianna, are directly connected in navigation interests, through the Missouri and Mississippi Rivers. To these may be added, the Territories of Minnesota, Nebraska and Kansas. Texas, also, on the Gulf of Mexico, is in very direct water communication with the navigation of the Ohio River. These States and Territories comprise within their limits even more than half the population of the Union; and since the introduction of the railroad system, working in harmony with these grand internal water communications, the commercial interests of all the States have become so interwoven that all are in reality interested in maintaining the navigation of this river.

The value of the commerce passing annually along the shores and miles of river between its head at Pittsburgh, and its mouth at Cairo, is enormous—not less than three hundred millions. And the business would annually increase much more rapidly but for the frequent and long continued interruptions caused by want of water in the channels. Hence, the preservation and improvement of this stream as an economical avenue for the interchange of a national commerce, has assumed a national importance.

The destruction or serious injury of a channel so advantageously placed, and forming a vital link of an almost boundless system, would therefore injuriously affect the commercial, manufacturing, and agricultural interests of the country. Such, indeed, has been the case to the extent of millions of dollars in more than one season, and especially in 1856.

Steam has given to our rivers an importance as commercial arteries which can scarcely be overrated, and the steamboat interest on our western waters now includes an aggregate capital of at least one hundred millions; over twenty millions of which are invested in steamboats alone. The interior steamboat interest is second only in amount to the railroad capital; the two combined, taking the entire Union, probably amount to one thousand millions of dollars.

Regarding our rivers and railroads, with their steamers, and locomotives, and cars, as the machinery for the mere *movement* of the trade and travel of the States, what must be the grand aggregate value of the things conveyed? Before the introduction of the steamboat, the trade on the Ohio River, and on all of the western waters, was quite small, and confined chiefly to descending craft which floated with the current. Had the same primitive mode of conducting business continued to this day, the increasing irregularities in the navigation would have attracted

little attention, because of the comparatively trifling interests concerned. But the country, through the instrumentality of steam, having become familiar with the real value of a great river navigation, and with its intimate and friendly relationship with the railroad system, now looks with anxious concern upon the melancholy fact which cannot be denied, that the river, instead of becoming better, is gradually becoming less and less reliable as a navigation. The cause of this failure appears to be almost by common consent ascribed to the gradual cleaning away of the timber from the head waters and along the main streams. It seems to operate in two ways: by lessening the annual downfall of rains and snows, and by augmenting the annual evaporation.

For months consecutively, and occasionally through almost an entire business season, no dependence can be placed upon the river as a channel of shipping, particularly by those living at a considerable distance therefrom, as there is a general apprehension that by the time goods may reach a given point, the water may have receded. This causes millions of dollars worth of property to lie idle for long periods as dead capital; restricts the manufacturing capabilities of the manufacturing cities, limits the agricultural productions, and of course decreases the commercial prosperity of the country. The evil has become so notorious—the public feeling so aroused to the necessity and expediency of attempting some radical remedy, that little doubt can be entertained that Congress during its ensuing session, will at least provide for the necessary preliminary surveys and investigations, or in such manner as will speedily determine the question as to the best plan for permanently improving the river.

Having conceded that Congress will probably pass a law authorizing the examination of the whole subject, the inquiry naturally arises, "why then discuss it in advance?" In answer, it may be said, that although there are some features the merits of which can only be finally settled from the results of actual surveys; there are others, important and interesting, which the engineers and practical men generally of this country, may investigate beforehand; the elaboration and determination of which are not dependent on future surveys: that there are elements enough already within reach, worthy of the attention and examination of the ablest minds of the land.

The question is not merely one of dollars and cents that may be involved in the adoption and completion of a particular plan; it is of the first consequence that that plan shall be one with which the sober good sense of the country will rest satisfied, and which, in the end, will be productive of the greatest benefit.

The engineering features are of sufficient magnitude to entitle them to the candid and thoughtful consideration of the entire profession; and a fair discussion of them should be encouraged and aided by our civil engineers. Several members of the profession have already taken part in it, and in their different papers and publications may be found many interesting views.

Much desultory writing, and various crude suggestions have been thrown off for a long period of years; and for several years, between 1837 and 1840, the government was actually engaged in improving the river by means of loose stone wing dams, but without much effect.

Locks and dams were suggested at an early day by Edward F. Gay, Esq., Civ. Eng., and others; and in 1839, after some experience on the Slackwater Improvement of the Monongahela River, the writer ventured to entertain and express the opinion that at some future period the Ohio River might be thus improved.

In 1849, Charles Ellet, Jr., Esq., Civ. Eng., wrote a paper on the subject of the "Physical Geography of the Mississippi Valley," published by the Smithsonian Institution, in which he promulgated and recommended his plan for the improvement of the Ohio and other western rivers, by means of *Artificial Reservoirs*, to be constructed on the navigable branches, or on the smaller tributaries. The water thus stored to be drawn out in dry seasons, to keep up the regular flow of the rivers. The same general ideas were reiterated, in a larger work "Upon the Mississippi Overflows," published by Lippincott, Grambo & Co., of Philadelphia, in 1853. In March, 1855, Josiah Copley, Esq., an intelligent gentleman of Pittsburgh, who had paid considerable attention to the subject of the improvement of the Ohio, prepared an article which was published by direction of the Board of Trade; and January 1st, 1856, another, both appearing in pamphlet form, under the auspices of the same Board. Mr. Copley has exerted himself not only in writing, but in various ways to point out and enforce the great necessity and importance of a radical improvement of the river.

In 1855, Herman Haupt, Esq., Civ. Eng., published a work in pamphlet form, entitled "a Consideration of the Plans for the Improvement of the Ohio River," in which, after reviewing the plan of "Locks and Dams," and the "Reservoir Plan," he proposed a third plan, to consist of a succession of open dams of 6 to 10 feet height, without locks; the pools to be connected by an open channel 200 feet wide; the channel to be formed by means of mounds or embankments extending lengthwise from the end of the dam far enough up each pool to equalize the flow. In fact, it would make a navigable canal 200 feet wide, with an average descent between Pittsburgh and Cairo of about 6 inches per mile.

In the Spring of 1856, Mr. Ellet condensed and arranged his views into a more popular shape, and published them in the *Cincinnati Gazette*. Soon after, at the request of a friend, an answer was prepared by the writer, which was published by the Board of Trade of Pittsburgh. This answer was not designed to be regarded as the argument on behalf of locks and dams; its main object being to correct what appeared to be erroneous in the published papers of Mr. Ellet. It was republished in January of this year, in the *American Railway Times*, Boston.

In January, 1857, Ellwood Morris, Esq., Civ. Eng., commenced the publication of a paper "On the Improvement of the Ohio River," in the *Journal of the Franklin Institute*, which was continued in February, and concluded in the March number. It has since been published in a separate pamphlet.

It is certainly true, that the writings of these three gentlemen, Messrs. Ellet, Haupt, and Morris, as literary productions, are highly creditable to the profession.

Previous to the publication of any of these papers, in 1838 and 1839, Major (then Captain) Sanders, of the Topographical Engineers, was engaged as Government Superintendent; first, in surveying the Ohio River, and then in planning and carrying into execution certain improvements (already alluded to,) partially by means of wing dams, and partially by cleaning out the channels. Even after the suspension of these operations, Major Sanders continued the advocate of that method of improving the navigation; although it is proper to state, in this connexion, that he promised only a two and a half feet stage in low water, without the aid of artificial reservoirs. Considerable money was expended, some good was accomplished, but the appropriations were discontinued, and the work ceased. A further reference to this plan will perhaps be made, incidentally, in the course of this paper.

Long anterior to this period, from 1824 to 1826, a private corporation styled the "Louisville and Portland Canal Company," had constructed a steamboat canal and locks around the Louisville Falls, under the direction of Canvass White, Esq.,* Civ. Eng. The locks were made of sufficient size to accommodate the steamers of that day; but the great increase in the dimensions of steamers afterwards led to much inconvenience. Many being too large to pass through the locks, could only "run the falls" during high water. Government became a purchasre of the stock of this company, and now controls the works. Extensive repairs were made to these works in 1856, at the expense of the general government, under the direction and superintendence of Edward Watts, Esq., Civ. Eng., who, at the instance of the War Department, has furnished plans and recommended an appropriation for their permanent enlargement on a magnificent scale. This is the most difficult and expensive point on the whole river.

From 1837 to 1840, the writer was engaged as Engineer of the Monongahela Navigation Company, in surveying that river, and planning and erecting the locks and dams forming the slackwater between Pittsburgh and Brownsville. He afterwards made a survey for the Ship Canal, at the Sault St. Marie, and aided for a number of years in urging that great work upon the public attention. But it should not be inferred that it is his design to make this paper a mere advocacy of any one plan for improving the Ohio River. On the contrary, it shall be his aim carefully to examine, and fairly present all the plans, for the further consideration of the public; holding this paper like those papers he shall consider, subject to criticism from any interested party.

It is proposed to consider the several plans in the following order:

1st. The *Reservoir Plan* as proposed by Mr. Ellet; chiefly as modified in detail by Mr. Morris.

2d. The *Low dam and chute plan* without locks, as proposed by Mr. Haupt, but chiefly with some modifications suggested by the writer.

3d. The "System of Locks and Dams," with sluice-ways or chutes for descending craft.

I. The Plan of Artificial Reservoirs.

It is stated, that the area of country drained by the Ohio River, its

* Some time since deceased.

confluents and tributaries, above the City of Wheeling, is 24,337 square miles. From a careful examination of good maps showing the sources of the streams, the writer believes that this is sufficiently accurate for all the purposes of this discussion.

Estimating the *available* average annual downfall of water in the region under consideration at 12 inches,* the whole number of cubic feet would be 678,476,620,800. So that if the whole were stored in reservoirs, it would afford a daily flow of 1,842,401,700 cubic feet; which according to the calculations made by Mr. Ellet, of the quantity passing at Wheeling at different stages of the river, would give a constant depth of *eight* feet. It is proper to mention, however, that during one year, as shown by the record kept (in 1845), the actual flow, according to Mr. Ellet's calculations, would have furnished a constant depth of but 7 feet over the bar at Wheeling. This proves from the calculations, that there has been a year when the available downfall was less than 12 inches. It was in fact but 9·83 inches, according to the calculations of Mr. Ellet and Mr. Morris.

But the record of the height of water at Wheeling, kept through a period of years, as elaborated by Mr. Ellet, having shown that more than enough water passed down, *even in the driest year*, if it had been equalized throughout the season, to have afforded a constant depth of more than six feet; and any reasonable calculation based on the extent of country drained, showing a like result, it leaves no room for controversy in regard to the first important proposition; and it must be granted that enough water *falls* every year, if it could be equalized, to give six feet depth constantly over the bar at Wheeling.

The object of the advocates of the artificial reservoir plan, being to secure a constant depth of six feet at Wheeling, we may next consider whether the data obtained from the daily record of the height of the river, taken in connexion with the measurements of the rate of flow, and the calculations based thereon, are sufficient to show, without further examination, how much water must necessarily be stored in reservoirs to accomplish this result through the driest year recorded. This second point has been but imperfectly investigated, and yet without further surveys, some additional light can be thrown upon it.

The driest season, 1845, would have yielded an average depth of but *seven* feet at Wheeling, from an available downfall of less than 10 ins.; and yet Mr. Morris assumes in his calculations, 18 inches as the reliable depth from the drainage of 3600 square miles; and also, that the drainage of this area is to be stopped and held by six dams, not exceeding 100 feet in height. Now, as works of this sort must be planned for extreme cases in order to be constantly useful, would it not be the part of prudence to take the dry seasons as the gauge? Similar seasons in future may be more frequent than they have been in the past. Founding our calculations on such a dry season, we ought not to assume much more than half of the depth allowed by Mr. Morris as available from the drainage; though other engineers as well as the writer, in reference to this very region, have heretofore estimated a depth of 12 inches, or two-

* The important practical question—how much water from drainage may annually be *relied upon* to be stored in artificial reservoirs draining given areas! will be considered in another place. (See Appendix A.)

thirds of Mr. Morris's quantity. Mr. Ellet says, "The discharge is therefore about 40 per cent. of the total fall, showing that 60 per cent. of all the rain and snow that come to the earth in this latitude is carried back to the clouds in vapor and never reaches the ocean," and that "the *average* annual fall of rain at the head of the Ohio is 36 inches." Now this necessarily implies, that in some years it must be *less* than 36 inches. The experience of the writer, in connexion with a reservoir on one of the tributaries of the Ohio above Wheeling, led to the conclusion that it is not safe in this latitude to count on saving or utilizing more than 33⅓ per cent. of the annual downfall of rain and snow. A further investigation of this very point made some years ago by the writer at the instance of Major Walter Gwynn, Civ. Eng. of Virginia, confirmed this opinion. This being settled, it would, according to the other calculations of Mr. Morris, require *nine* instead of *six* large reservoirs of capacity sufficient to contain the drainage of 600 square miles each, and 5400 square miles in the aggregate. And of course, if his estimate of $12,000,000 for six reservoirs be correct, it will be equally correct to assume $18,000,000 for nine.

But the elements which belong to the moderately sized reservoirs, hitherto constructed in this and other countries, for the purpose of supplying canals or water-works, will not be found as component parts of the *immense artificial lakes* introduced into this question, as means for maintaining a steady flow in large navigable rivers. Where a reservoir is to be constructed large enough to hold the entire drainage of 600 sq. miles, (even allowing but 12 inches instead of 18 to be available,) there is little opportunity of choosing sites "near or upon elevated grounds, with moderately steep water-sheds of ordinarily impervious material;" because if you take sites near or upon such elevated grounds, you cannot command the drainage of enough territory to meet the other requirement—600 square miles. Again, Mr. Morris perhaps, without sufficient scrutiny of the calculations of Mr. Ellet respecting the quantity of water that a given height of dam will hold in check, has largely over-estimated the actual capacity of any such reservoirs. He proposes dams of 100 feet height, and assumes that they will afford over the whole superficial area overflowed, an average depth of half the greatest depth at the dam; whereas, it will be found, that this average depth will not be more than one-third to four-tenths of the greatest depth at the dam. It is practicable to build dams 100 feet high on the tributaries; but is it practicable to unite with them the requirements of 600 square miles of drainage, and the capacity of the reservoirs to contain the drainage, for nine such structures, or for six, or what number? In the case of a *small* reservoir, such as might yield a supply for the Ohio River for half a day, it is barely possible that a site could be secured where the average depth might be *nearly* half the greatest depth at the dam;* but for the *great reservoirs* now under consideration, the average of half the greatest depth can only apply to that portion of the reservoir which is directly above the natural *bed of the stream* itself. Whatever space is occupied by the bottom lands, and side hill slopes of the valley, must go to reduce the average depth.

* It could not be as much as *half*, except in a case where there was no valley save the river or creek itself; and where the sides were vertical. Such a site does not exist on any of the head-waters of the Allegheny River.

The surveys, if made, will probably show that *one-third* of the greatest depth is a liberal average to allow. This would reduce the *capacity* of the assumed reservoirs one-sixth.

Take an ordinary case of a stream 300 feet wide, falling 4 feet per mile, with bottom land on one side 500 feet wide, 25 feet above the stream, and side hill slopes of 4 feet base to 1 foot rise. Throw across a dam 100 feet high; the average depth even *at* the dam is but 65·8 feet, and half way up the pool, but 31·1 feet. Take another case similar to the above without any bottom land: the average depth at the dam will be 63·6 feet, and half way up the pool 35·7 feet. And where there are bottom lands of even moderate height, the upper miles of the reservoir would be confined within the narrow limits of the natural stream. In a vast majority of all the reservoirs which could be formed either on the main streams or on the tributaries under consideration, the actual shape of the whole prism of water will be found to approach the form of a *cone* more closely than that of the *wedge*. Hence it will not answer to assume one-half the greatest depth at the dam as the average depth of reservoirs.

Starting upon the data assumed by Mr. Morris, that each reservoir is to hold the drainage of 40 by 15 miles, or any other shape containing 600 square miles, we at once determine one point: that the dam must not be erected above the point commanding that drainage.

A second point may be determined without additional surveys: that in order to secure one of the important elements of these proposed reservoirs, namely, not over 4 feet per mile fall in the stream, it will be necessary to choose a site even farther still from the sources of the tributaries. It may even appear, that no such site exists on any of the smaller tributaries. And thus the future surveys may be materially limited in their scope. And perhaps, without further surveys, the question may be *settled*, whether numerous small reservoirs or a few large reservoirs, may be the proper plan of any system of artificial reservoirs. But, in the present stage of our investigation, we confine ourselves mainly to the general outlines laid down in Mr. Morris's paper. For the present, therefore, we pay no particular attention to the reservoir characteristics of streams below a point that will secure the available drainage of 600 sq. miles; though without granting that even at that distance from the sources, all the elements designated can be obtained. Let us look at this practically, by the light we can command.

Wheeling is the starting point; that being the place where the records of the height of the river and the measurements of its flow were made, upon which the reservoir plan as yet stands.

It is not very important that the tributaries flowing into the Ohio between Wheeling and Pittsburgh should be critically examined, now, or at any time, for the reason that if the reservoir plan should be adopted, the artificial supply must enter as high as Pittsburgh; the water failing there as much as at Wheeling in dry seasons, with a more rapid fall per mile. We will, however, briefly refer to the principal tributaries entering below Pittsburgh.

On the left or east bank occur, Short Creek, Cross Creek, Raccoon Creek, and Chartier's Creek. The largest, Chartier's Creek, drains an

area of only about 300 square miles; so that even with a dam at its mouth, it would only secure half enough for one reservoir. Raccoon Creek, the next in size, drains only about 160 square miles.

On the right or west bank occur, Wheeling Creek, Short Creek, Yellow Creek, Little Beaver River, and Big Beaver River.

Little Beaver River drains about 400 square miles. Yellow Creek about 200 square miles. The Little Beaver runs through a narrow valley, with but occasional bottom lands on the lower 20 miles of its course. New Lisbon, the capital of Columbiana County, Ohio, is situated on this stream, 25 miles from its mouth measured along its windings. Below New Lisbon, it rises at the rate of about 8 feet per mile; above New Lisbon it rises still more rapidly. The best place for a high dam on the Little Beaver, is near its mouth. A dam 100 feet high would, however, back the water but 12 miles instead of 25, and the pool it would form would contain less than 2,000,000.000, or not more than *one-fifth* of the available drainage of even 400 square mile. A dam at the point just named, would destroy several valuable mills, but not much valuable bottom land.

We next come to the Big Beaver River, 28 miles below Pittsburgh. This is long enough, and drains territory enough to meet *one* of the requirements for a *large reservoir*. Its extreme length from its sources at the beads of the Shenango in Ohio and Pennsylvania, being 120 miles. To obtain the drainage of 600 square miles, the dam must be placed as far down the Shenango as the vicinity of Sharon. From Sharon upward towards Greenville, the stream rises 5 feet per mile, above Greenville 7 feet per mile. A dam 100 feet high between Sharon and Clarksville, would back the water about 17 miles. It would flood Clarksville, Greenville, and several valuable mills, and destroy 17 miles of the Pennsylvania Erie Canal, now the property of a private corporation; and its pool would not contain more than one-third of the drainage of 600 sq. miles. At Greenville, the Shenango forks, and if a dam were built on either fork so as to save Greenville, it would not secure the drainage of more than 170 square miles on one fork, or 150 square miles on the other. The only resort then would be farther down the Beaver, or upon its Mahoning Branch. Taking the Mahoning, which enters the Beaver two miles below Newcastle, Pennsylvania, it will be found that to obtain the drainage of 600 square miles, the dam should be not far from Warren, the county seat of Trumbull, Ohio. A dam 100 feet high if placed below, would submerge Warren, 20 miles of the Pennsylvania and Ohio Canal, several valuable coal mines, mills, and excellent farm land, and a number of miles of the Cleveland and Mahoning Railroad. In fact, it is inadmissible there, or at any point between Warren and Newcastle. Just above Warren, a dam would secure the drainage of 600 square miles. Whether a dam of one hundred feet height would accomplish it, is not certain, but possibly it would, as the country is comparatively flat, and at the same time well improved and cultivated. It would require a very long dam, and would destroy 20 to 25 miles of the Cleveland and Mahoning Railroad, 20 to 25 miles of the canal, and much other property, involving very heavy damages. The land damages alone would not be less than a million of dollars independently of other damages

named, and the destruction of towns. The inhabitants of that region of country, would not permit the erection of such a structure. Practically, there is no place where such a work is admissible on the Mahoning branch of the Beaver.

The dernier resort, so far as the valley of the Big Beaver is concerned, would be the *main stream* between Brighton and Newcastle. There is already on that part a succession of dams forming the slackwater of the "Beaver Division," as it is called. A dam 100 feet high erected just above New Brighton, would back the water about as far as Newcastle, say 20 miles. It would form a pool that might average 35 feet deep for 1000 feet of average width in the main valley, and half as much more up the tributaries This would make a total of 7,920,000,000 cubic feet, or less than a third of the drainage of 600 square miles. The damages would not be very heavy except the cost of the *new locks* and towing path along the new pool, in view of the old locks, &c., for 100 feet of lockage. A few hundred thousand dollars perhaps, would cover all. This is undoubtedly the only place on any part of the Big Beaver where a large dam of the kind could ever be located, and yet even here, it would not afford one-third the quantity assumed as proper to such a dam.

Above the Big Beaver no tributary of consequence enters on the western side of the Ohio until we ascend to Pittsburgh, the veritable head of the river.

Starting at Pittsburgh, let us first take the Monongahela and its branches; beginning at the head waters of the Youghiougheny, in the State of Maryland.

It is less than 40 miles from its farthest source down to the Pennsylvania State line, and not more than 350 square miles are drained in Maryland. In order to obtain the drainage of 600 square miles, a site must be chosen in Pennsylvania, probably at the passage of the stream through Laurel Hill Ridge. But the fall in this part of the Youghiougheny is 10 *feet* per mile; so that a dam 100 feet high would back the water only 10 miles, and the pool created thereby would not probably contain more than *one-fourth* of the entire drainage of 600 square miles. According to data furnished in Mr. Ellet's paper, the fall in Youghiougheny even between Smethport and Connelsville is 393 feet, which must be more than 10 feet per mile. It is evident, therefore, that the Youghiougheny is not favorable for the establishment of one of the contemplated large reservoirs, unless it could be located towards its mouth, along the present slackwater navigation. In that event, it would of course involve the construction of 100 feet lift of new locks, besides the submerging of several towns, mills, coal banks, and other valuable property. None of the *tributaries* of the Youghiougheny would afford a site having any thing like the adequate extent of drainage.

We next proceed to the other head waters of the Monongahela. Take *Cheat River*, which enters the main stream within Pennsylvania, a few miles below the Virginia State line. It is a Virginia stream. In regard to this branch of the river, Mr. Ellet states, that in the first forty-seven miles above its junction with the West fork it falls 600 feet, or 13 feet per mile. It is obvious, therefore, that this will not meet a requirement based on a fall of only 4 feet per mile; and that a hundred feet dam,

instead of backing the water 25 miles, could only flow 8 miles; and that the quantity likely to be stored in such a pool, would fall very far short of the quantity assumed by Mr. Morris.

Next comes the West fork or main Monongahela River, also, a Virginia stream until it enters Pennsylvania, about ninety miles from Pittsburgh. The fall of this steam from Weston in Virginia, to the forks above mentioned, is only about two feet per mile. From the remarkable fact that the Monongahela River even so near to its head has so little fall, it may fairly be inferred that here is a favorable site for one of the proposed large reservoirs.

The Monongahela Navigation Company would, it is to be presumed, favor and perhaps aid the construction of a large reservoir on the head waters in Virginia, as it would relieve them from the difficulty they now labor under in dry seasons for want of a sufficient supply of water. If made large enough to aid essentially in improving the navigation of the Ohio River, it would afford hydraulic power on the Monongahela of some value. The question yet to be determined on the Monongahela will be the proper location and probable cost of the structure necessary to form the reservoir. For this the writer does not possess the data. But its erection would involve the necessity of some efficient and convenient arrangement for passing the rafts and other descending craft of a body of owners and dealers jealous of their navigation and hydraulic rights and privileges.

Leaving the Monongahela, we will now proceed northward up the Allegheny, which is the main prolongation of the Ohio; taking first the right bank or west side, and dwelling but little on tributaries which drain only a small area of country. The first considerable tributary is Bull Creek, which enters just below Freeport, 27 miles above Pittsburgh, and that drains only 150 square miles. There is none even as large as Bull Creek, until we reach French Creek, 130 miles above Pittsburgh. The Allegheny River at the mouth of French Creek is 261 feet above the river at Pittsburgh, showing an average descent of 2 feet per mile on the whole distance.

French Creek is a very important tributary of the Allegheny River. It was gauged during the summer of 1839, under the direction of the writer, by James Worrall, Esq., Civ. Eng, and found to yield in round numbers 22,000 cubic feet per minute. It was a low stage, but not by any means its very lowest stage, but probably affording a fair criterion of its flow in *ordinary low* water. This stream rises within less than eight miles of Lake Erie, in Erie County, Pennsylvania, and in Chatauque County, New York. Near its head, the country is comparatively flat. A point 40 miles from its sources, would be near Meadville, above which flourishing town, the well known capital of Crawford County, a dam could be built which would be below the drainage of 600 square miles. The fall in French Creek for a distance of 15 to 20 miles above such point, is 4 feet per mile. A dam 100 feet high would therefore flow the water back about 25 miles; and, from the shape of the valley, it might perhaps hold half of the drainage of 550 square miles, which is about the area drained by French Creek above Meadville, leaving out, of course, the drainage of Cassawaga Creek, which enters below where the dam could be built.

Such a high dam would submerge several mills, several towns, numerous roads and houses, and much excellent and well improved farm land. If constructed, it would be necessary to furnish from its pool sufficient water for the supply of the French Creek feeder, a navigable canal 22 miles in length, and for 45 miles of the Conneaut line of the Erie canal, and 10 miles of the Shenango line, all of which being 77 miles of canal, are now *wholly supplied* from French Creek, from Bemus' Dam 2 miles above Meadville; and none of which supply returns again to any part of French Creek. The flow is about 7260 cubic feet per minute for about 8 months of the year; assuming the area to be 75 square feet, and the rate 1·1 miles per hour, where it passes the aqueduct. It may be, that the water power leases may require this flow for the entire twelve months. In that case it would take 50 per cent. more, and the total quantity would be for a year, 3,750,000,000 cubic feet.

Again, French Creek falls between Meadville and Franklin, (the capital of Venango County, at the mouth of the Creek,) 30 miles, at the rate of about 4 feet per mile, so that a dam 100 feet high would flow back 25 miles. But if built below and yet within 20 miles of Meadville, it would submerge it. It would also back the water up the Conneaut outlet, and overflow Conneaut Lake, and waste part of the water into the Shenango Valley, running southward into the Big Beaver River, and part into the Conneaut Creek, running northward to Lake Erie; for it is a curious fact, that the water from French Creek, which naturally belongs to the Ohio Valley, now forms the sole supply of 45 miles of the northern end of the Pennsylvania Erie Canal, and empties into the Lake at Erie. To admit of a 100 feet height of dam, the structure must be located within two or three miles of Franklin. Here the valley is more confined by tolerably steep hills, and the quantity that could be stored in a reservoir would be very much less. The damages would also be less, but still they would constitute a heavy bill of expense. Therefore, although theoretically there is a reasonably good site for *one* of the great reservoirs on French Creek, practically there are serious difficulties to be encountered and overcome. And at the best, no single dam of 100 feet height on French Creek would contain more than half the drainage of 600 square miles.

The next tributary of considerable size above French Creek, is Oil Creek; but it drains an area of only about 270 square miles. It falls 4 to 5 feet per mile.

Next in order is Brokenstraw Creek, draining only about 240 square miles.

Then comes the Connewango Creek, entering the Allegheny at Warren, the capital of Warren County, Pennsylvania. This Creek drains about 960 square miles, including Chatauque Lake, in Chatauque Co., New York. To secure the drainage of 600 square miles, the dam should be put not farther down than Frewsville, which is about 15 miles above Warren. The distance from Chatauque Lake to Warren, following the course of the Cassadaga and Connewango Creeks, is about 29 miles, and the fall 119 feet, or about 4 feet per mile. A dam near Frewsville, 100 feet high, would overflow Chatauque Lake about 40 feet; which it is presumed is not admissible. It would, therefore, have to be located

within 4 or 5 miles of Warren, across the main Connewango Creek. Not being personally acquainted with this stream, no further remarks in relation thereto will be made in this place. Possibly it may be favorable.

Above the mouth of the Connewango, there is no tributary of the Allegheny on the same side, whose area of drainage would approach the requirement of 600 square miles, or even half of it.

Returning to Pittsburgh, we take the left or east bank of the Allegheny River. Between Pittsburgh and Freeport, 28 miles, no tributary enters which drains more than about 50 square miles.

Just above Freeport, we meet the Kiskiminetas River, second only in importance to French Creek, in its extent of drainage and supply of water to the main river. It is over 100 miles long, and its sources are on the western slopes of the Allegheny Mountain, in Cambria and Somerset Counties, Pennsylvania. Forty miles from the most remote head of the Stony Creek branch, would extend below Johnstown, and as far down as the passage of the Conemaugh* River through *Chestnut Ridge*, a spur of the great Allegheny chain. A dam at Chestnut Ridge, would be below the drainage of about 700 square miles. But a dam built there, would be of great height if required to form a pool of sufficient size to contain the drainage of 600 square miles, as the valley is narrow, and the hills steep, between Chestnut Ridge and Laurel Hill, and for most of the distance from Laurel Hill to Johnstown; and the effect of such high dam would be to submerge Johnstown, the Pennsylvania Central Railroad, the State Canal, the State Railroad above Johnstown, and the Cambria Iron Works; in which latter more than a million and-a-half of dollars are invested. It would, besides, destroy a large amount of other valuable property. It may, therefore, be regarded as *impracticable* at any point that would flood Johnstown.

At Johnstown, the stream forks, this being the junction point of the Conemaugh River and Stony Creek. On the Conemaugh, or rather a branch of it, a reservoir has been constructed for the purpose of supplying the western division of the Pennsylvania Canal in dry times. It was built by the State, under the direction of Wm. E. Morris, Esq., Civil Engineer. It is said to contain 466,000,000 cubic feet of water, and to have cost $166,000. The Conemaugh Reservoir is entirely out of the way of injuring the public works; its location being south of the old Allegheny Portage Railroad. Whereas, owing to the location of the Pennsylvania Central, and the new State Railroad, in the immediate valley of the Conemaugh, all the way from Johnstown to its head, no large reservoir could possibly be permitted in this stream above Johnstown.

Stony Creek remains. The entire drainage of Stony Creek, and all its branches, is only about 400 square miles, or but two-thirds enough for one of the proposed large reservoirs. If, therefore, a dam were thrown across it near its mouth, in the vicinity of Johnstown, it would not hold the drainage from more than 300 square miles, unless it were more than 100 feet high; and the damages to mills and improved property would be heavy.

* Above the mouth of Blacklick Creek, just below Blairsville, the name of the main stream is Conemaugh, below that, Kiskiminetas.

Turning to the Conemaugh below Laurel Hill, and above Blairsville, we can find a point where a dam 100 feet high could be erected without very heavy damage to private property, because the valley is very narrow, and the side hills generally steep; but it would submerge a portion of the PennsylvaniaRailroad, and involve the building of 10 or 12 new locks on the Pennsylvania Canal, and a very complicated arrangement that would permit the pool to be emptied for supplying the Ohio River, without seriously incommoding the *canal navigation.* But owing to the contracted width of the valley, and the amount of fall in the stream, the pool would not contain one-third of the drainage of 600 square miles.

Below Blairsville, the principal tributary of the Kiskiminetas, is the Loyalhanna, a fine stream, but draining only about 300 square miles. A very high dam at or near its mouth might control the drainage of that area, but the damages to valuable farms, buildings, and mill property would be very great.

Blacklick Creek, the only other remaining tributary worthy of notice, entering the Kiskiminetas below Blairsville, drains somewhat less than 300 square miles.

We then come to the main Kiskiminetas River, the fall in which is about 4 feet per mile. A dam 100 feet high would therefore flow back about 25 miles. The valley at the height of an average of 50 feet above the present low water, would be about 1200 feet wide. Such a reservoir would probably contain, including the flow back along the tributaries, about 8,000,000,000 of cubic feet, or not quite one-third of the requirement for one of the large reservoirs; and about one-half of the drainage of 600 square miles, allowing 12 inches per annum as available. It would require the construction of 100 feet vertical of new locks, or 10 locks of 10 feet lift each, and some new and peculiar arrangement to allow for the gradual drawing down of the pool, so as to maintain the canal navigation as the water should be discharged for supplying the Ohio River. It would submerge 20 or more miles of the "North Western Railroad," and destroy not less than twenty valuable salt wells, several considerable towns—Leechburg, Warren, Saltzburg, or at least two of them, and several very valuable water-powers. The damage to landed property would not be heavy. The dam would have to be located far enough above the mouth of the Kiskiminetas, to leave room for the North Western Railroad to be rebuilt on a new route with a moderate grade, as in the vicinity of the dam the railroad would necessarily have to be about 110 feet above the present surface of the water. This would make the new route of the road much more costly than the old one, on account of the expensive crossing of the tributaries at a higher level.

Leaving the Kiskiminetas, we come to Crooked Creek, which drains only about 280 square miles, and enters the river a few miles below Kittanning. Its valley is narrow, and it has a rapid fall, and is not well adapted for the purpose of a single large reservoir. Next is the Cowanshanoc, which enters a short distances above Kittanning. It does not drain over 75 square miles, and falls more than 10 feet to the mile.

Next above is the *Mahoning*—a fine stream, draining nearly 400 square miles. Its valley is very narrow, and bounded by steep side

hills. Its average width at the height of 50 feet above low water, is not more than 600 feet; and it falls so rapidly (8 feet per mile), that a dam even at its mouth, 100 feet high, would not back the water more than about 12 miles.

Next we have Red Bank, another fine stream. This drains about 650 square miles. Its valley is rather wider than that of the Mahoning. Between its mouth and the town of Bethlehem, it may average, at 50 feet above low water, 900 feet wide. It falls here at the rate of $7\frac{1}{2}$ feet per mile; so that a dam at the mouth, or any where between the mouth and Bethlehem, 100 feet high, would flow back only about $13\frac{1}{3}$ miles. Such a pool would probably contain about 3,300,000,000 cubic feet, or about one-sixth of the drainage of 600 square miles Above Bethlehem the valley is wide, and the country well improved. A dam on the stream above Bethlehem would hold more than one below, but it would lose part of the drainage, and the damages would be much heavier.

Both the Mahoning and Red Bank, which are navigable for descending craft, and out of which an immense amount of lumber and timber is annually rafted, would have to be arranged so as to secure the safe passage of rafts, &c. A dam above Bethlehem would also submerge the located track of the Allegheny Valley Railroad. Above Brookville, which is the capital of Jefferson County, the stream has more fall, and becomes less and less advantageous as reservoir ground; the heads of the streams falling more than 30 feet in a mile.

We come now to the Clarion River, about 85 miles above Pittsburgh. This is the largest tributary above the Kiskiminetas on the same side, and drains about 1400 square miles. From the town of Clarion, the capital of Clarion County, down to Callansburg, near the mouth of Big Licking branch, it has a fall of $6\frac{1}{4}$ feet per mile, with an average width of about 200 feet, and as high as Ridgway, the capital of Elk County. Above Ridgway it forks, and both forks have more than 7 feet fall per mile, until within a few miles of their heads, where they are quite abrupt, falling off more than 50 feet per mile. A dam to secure the drainage of 600 square miles, should be located as far down as Ridgway. In order to save Ridgway it would be necessary to place the dam, if built 100 feet high, about 15 miles below Ridgway, or farther. The valley of the Clarion River, between Ridgway and Clarion, is generally quite narrow. On much of the distance there is scarcely any bottom land, and the hill sides are tolerably steep; but not so steep as on the Mahoning. At the height of 50 feet above low water, the average width may be 1000 feet or rather more. Assuming it to be even 1200 feet, the pool of a dam 100 feet high, would hold about 5,300,000,000 cubic feet, or not quite one-third of the drainage of 600 square miles, 1 foot deep.

A dam *above* Ridgway would not catch the drainage of more than 250 square miles, and if built 100 feet high, it would not hold more than half of that drainage on account of the rise in the bed of the stream, and the shape of the valley; the rise from Ridgway up, being at first 7 feet per mile, gradually increasing to more than 50 feet per mile. It is probable, then, that the most advantageous site for a large reservoir any where on the Clarion waters, will be found between Clarion and Ridgway

where the fall is about $6\frac{1}{4}$ feet per mile. But there is no point on the entire river where a single dam 100 feet high will back the water 25 miles, or be likely to form a reservoir holding half of the quantity required for one of the large reservoirs.

Next comes the *Tionesta*, about 35 miles above Franklin, which with its Raccoon fork, drains about 500 square miles. The Tionesta is much more rapid than the Clarion, and runs for the most part through the wildest region of Pennsylvania, in the shades of deep and steep gorges. Although damages on this stream would be an unimportant item, the contracted width of the valley, and the abrupt declivities of its sides would make costly reservoir work, if attempted on the large scale. Ascending the stream in search of a favorable location will be useless, as the ascent increases until its upper waters rise more than fifty feet per mile.

Next is the Kenjua Creek, of very similar general features, but draining only about 200 square miles, and not favorable for large reservoirs.

The last tributary of the Allegheny River, on the same side, deserving notice in this connexion is Potato Creek, and this drains only about 150 square miles. A high dam could not be built at its mouth, for two reasons: because the valley is very wide (nearly a mile, much wider than any part of the main river valley below Olean), and because it would submerge Smethport, the capital of McKean County, Pennsylvania. If built above Smethport, it would not drain more than 80 square miles. The Potato Creek is remarkable for its *wide valley* and very *slight fall*—only about 2 feet per mile from its mouth for 13 miles up; but as it gradually decreases in width towards its upper end, the fall in the stream becomes very abrupt like the other head waters.

Having thus traced the general characteristics of all the tributaries of the Allegheny River, approaching in extent of area drained the dimensions necessary for large reservoirs, let us now look at the main stream itself. Beginning at Coudersport, the capital of Potter County, Pennsylvania, which is within less than 10 miles of its extreme sources, we should secure only about 70 square miles; and here the main valley is much narrower than it is a few miles farther down, and the river descends rapidly; too much so for the economical saving of water on a large scale. We should be forced down as far as the mouth of Potato Creek, before we could command 250 square miles of territory for drainage. Even at the State line, where the river first enters New York, there would be but 500 square miles, including all of Potato Creek drainage. In two respects, the vicinity of the State line is advantageous as a site for a high dam; the hills approach each other within about half a mile, and the valley soon *widens out* above the line, and the fall in the main river is only about 2 feet per mile; but unfortunately a dam less than half of 100 feet in height would flood *Smethport*, Eldred, Kingsville, and numerous dwellings and fine farms, besides several important mills.

This flat-place, as it may be termed, in the Allegheny River, is a very peculiar feature, to which particular reference was made in one of the writer's reports a few years since. The course of the river for about 10 miles is almost due north, whilst its general direction is south. In

an engineering view, the point at the State line presents as favorable a site for the erection of a large dam for a reservoir as *any* above Wheeling; but even here, it could not catch the drainage of over 500 square miles.

The lumbering interests along this part of the Allegheny River, are *very important*, and cannot by any chance be overlooked in considering any reservoir arrangements. Proper provision would have to be made for the safe and convenient passage of a heavy trade in which nearly every individual in the region is in some manner associated. As secondary to this, it may be proper to mention that the Allegheny Valley Railroad is located along the bottom land between the State line and Smethport, and also, that a company has been incorporated to construct a slackwater navigation, designed chiefly for the great coal field of McKean County.

But before proceeding farther down the main river, let us briefly recapitulate the results of the foregoing preliminary investigations among the tributaries.

(To be Continued.)

AMERICAN PATENTS.

List of American Patents which issued from April 28th, to May 5th, 1857, (inclusive,) with Exemplifications.

APRIL 28.

176. For an *Improved Method of Manufacturing Raw Hide Whips;* Charles Bæder, Brooklyn, New York.

"My invention consists in making raw hide whips of a simple piece of hide, without a core or filling, the hide having only a slight twist given it."

Claim.—"Constructing raw hide whips without a core or filler, and giving the wrappers a slight twist."

177. For an *Improvement in Harvesting Machines;* J. F. Barrett, North Granville, New York.

"The nature of my invention consists in combining with a cutter or cutters, moving in a straight line parallel with the line of motion, oscillating or swiveling knives, which swing upon cutters, which move in a line parallel with the line of motion of the carriage."

Claim.—"The combination of the straight forward and back moving knife, or its equivalent, with the oscillating or swiveling knives."

178. For an *Improved Apparatus for Binding Grain;* J. F. Barrett, North Granville, New York.

"The object of this invention is to facilitate the binding of grain by manual agency. The nature of the invention consists in facilitating the twisting of the band by jaws, closed at the will of the operator, and made to revolve simultaneously with their grasping."

Claim.—"Twisting or tightening the band after it has been crossed upon the sheaf by the operator, by means of jaws working in balanced shaft, in combination with the devices for simultaneously closing and rotating said jaws."

179. For an *Improvement in Fire Arms;* Gustav A. Blittkowski, City of New York.

"My invention of improvements in breech loading fire arms consists in a peculiar method of constructing and operating certain parts at the breech, together with the lock, whereby I obtain greater security against accidental discharge, effect a perfect joint at the union of the breech piece with the barrel, together with great simplicity of parts."

Claim.—"The rotating and oscillating breech piece for receiving the charges, so attached to the stock as to be capable of being withdrawn from the end of the barrel, and elevated to receive the charge and to be returned thereto with a grinding and wedging action, whereby a secure and tight joint is effected. Also, the safety guard upon the end of the breech piece, so placed as to prevent the cock from striking the nipple, until the said breech piece is secured in the barrel."

180. For an *Improved Mode of Constructing Lockets, &c.;* Charles G. Bloomer, Wickford, Rhode Island.

Claim.—"1st, The making of locket rims out of single pieces of metal, instead of two or more. 2d, The making of them out of sheet metal instead of wire. 3d, The making of them, substantially in the manner described."

181. For an *Improved Side-walk Pavement;* John B. Cornell, City of New York.

Claim.—"Casting in one piece a section of a street gutter and curb of suitable shape and proportions. Also, forming the side-walk pavement of a series of metallic plates, when said plates are combined with each other, and with the aforesaid metallic street gutter and curb."

182. For an *Improvement in Locks;* Leger Diss, Ilion, New York.

Claim.—"The combination of the stop-holder, self-spreading stops, and the spring, with the tumbler moving the stop-holder and needle block. Also, the needle block, as attached to the stop-holder, with its series of needles or pins operating on the stops. Also, the key block; and also, the needle key fitted to its position."

183. For an *Improvement in Gilding and Ornamenting Steel and other Metals;* Alexander H. Dufresne, Paris, France; patented in France May 14, 1856.

Claim.—"1st. The application of gold and silver to metals incapable of direct amalgamation. 2d, The employment of photographic, heliographic, and printing processes, for the production of the reserves on the metallic surfaces to be operated on. 3d, The use of chromic acid for the destruction of the nickel, copper, antimony, or other metal employed in these processes."

184. For an *Improved Machine for Mortising the Stiles upon Blind Slats;* D. F. Drake, Leominster, Massachusetts.

Claim.—"The machine for cutting mortises for window blind slats, consisting essentially in the carriages, in combination with the cutters and bits."

185. For an *Arrangement of Ports in Steam Cylinders;* Bowen Eaton, Roanoke, Ia.

Claim.—"The arrangement of the central exhaust and end steam ports, for the admission of steam at each end of the cylinder only, and its eduction from the central part only—the latter being controlled entirely by the piston of the engine cylinder."

186. For an *Improvement in Fire Arms;* Josiah Ellis, Pittsburgh, Pennsylvania.

Claim.—"The arrangement of the traverse lever to permit of its playing on the same centre as the hammer, without danger of lateral derangement. Also, the use of the cam in the lock plate, in combination with the shoulder on the traverse lever, for the purpose of withdrawing the point of the traverse lever from the radial grooves in the rotating breech, in the reaction of the trigger. Also, the combination of the radial beveled grooves, in the rear end of the rotating breech, with the traverse lever, as applied to trigger cocking fire-arms, for the purpose of rotating and locking the breech preparatory to firing."

187. For an *Improvement in Seed Drills;* Ezra Emmert, Franklin Grove, Illinois.

Claim.—"The arrangement and combination of the wheels with the extension pieces."

188. For an *Improvement in Seed Planters;* George M. Evans, Pittsburgh, Pa.

"The nature of my invention relates to the adjustable fender surrounding the front and sides of the seed planter, for the double purpose of adjusting the depth at which the shoe shall run, and for shielding the supporting wheels and shoe from clods, &c., whereby the machine would be otherwise raised or lowered, or thrown from its direct path, by any obstructions meeting it."

Claim.—"The so uniting of the wheel and guard frame to the beam, and to the rods or bars, as that the operator may, from his position between the handles of the machine, adjust the depth at which the shoe shall open the furrow, by moving said wheel and guard frame forward or back."

189. For an *Improved Machine for Engraving Designs on Watch and Locket Cases, &c.;* Charles H. Field, Providence, Rhode Island.

Claim.—"The variable pattern disk, and the combination of the same with the stud for governing the cutting of the tool. Also, the combination and arrangement of the tappets and the stud; also, the tappet in connexion with the same, for imparting and regulating the motion of the pattern disk; also, the arm and the lever, and the mechanism attached thereto—the whole being so combined and arranged as to render the material self-operating. Also, the adjustable pitman for imparting the required motion to the vertical sliding plate."

190. For an *Improvement in Ink-stands;* Kingston Goddard, Philadelphia, Penna.

Claim.—"The application of the bent tube to a common ink bottle, whereby said common ink bottle is converted into an effective and economical fountain ink-stand."

191. For an *Improved Action for Grand Pianos;* Daniel F. Haasz, Philadelphia, Pa.

Claim.—"1st, Attaching the supporter to the key, and the lever and spring to the supporter. 2d, The arrester, with the lever as connected to the key, in combination with the adjustable wire as attached to the key frame."

192. For an *Improved Machine for Cutting Indexes to Blank Books;* George Hodgkinson and Theodore F. Randolph, Cincinnati, Ohio.

Claim.—"The arrangement of the machine."

193. For an *Improvement in Chronometric Locks;* Amos Holbrook, Milford, and Henry D. Fish, Hardwick, Massachusetts.

Claim.—"The confining of the frame bolt, and the releasing of the same, by means of the jointed portion, the embracing pawls and release levers, operated by said locks. Also, the partial setting back of the independent locking spring bolts, by means of the spring catch, until the closing of the door."

194. For an *Improvement in Harvester Frames;* M. G Hubbard, Penn Yan, N. Y.

Claim.—"Joining the parts of the frame by means of the lock plates or irons and bolts, so as to make a firm and rigid union between the parts at a small cost."

195. For a *Preparation of Photographic Pictures, Engravings, &c.;* S. Dwight Humphrey, City of New York.

Claim.—"As an improvement of the patent of J. B. Hall, the use of a semi-transparent media interposed between two transparent photographic pictures or engravings, for the purpose of blending the rays of light reflected from the rear colored photograph, and beautifying the picture."

196. For an *Improved Saw Gummer;* Oliver B. Judd, Little Falls, New York.

Claim.—"The method of constructing and arranging the posts, so as to cause the cutter to move in regular curves."

197. For an *Improvement in Atmospheric Pumps;* Levi Keiler, Catawissa, Pa.

"The nature of my invention consists in a certain arrangement for causing the elevation of water from mines by the condensation of air in a simple and effectual manner."

Claim.—"The combination of the water receiver and air induction pipe with the valve, acting with respect to the openings, when said parts are arranged with respect to air condenser and discharge pipe."

198. For an *Improvement in Brushes of Saw Cotton Gins;* Edwin Keith, Bridgewater, Massachusetts.

Claim.—"Inclining the heads of the brush cylinder from the periphery towards the centre, and opening the passages through the heads."

199. For an *Improvement in Submerged Propelling Wheels;* Thomas Kendall, Sen., San Francisco, California.

Claim.—"The means for feathering or changing the positions of the wings, consisting of the cam plates, concentric ring, and curved plate, with its slopes or planes."

200. For an *Improvement in Harvesters;* Isaiah Knauer, Valley Forge, Penna.

"The object of my invention is to prevent the access of dirt to the mechanism, by which the cutter bar is reciprocated, and provide for the constant lubrication of the same."

Claim.—"The peculiarly constructed close box, in combination with guides and cover."

201. For an *Improved Street Sprinkler;* Curtis O. Luce, Brandon, Vermont.

Claim.—"The combination of the water reservoir, horizontal, rotating, discharging wheels, operated from the wheels of the carriage, and the conveying pipes, provided with the cocks."

202. For an *Improvement in Churns;* H. N. Mackey, Morgantown, Virginia.

Claim.—"The combination of the oblique wings, with the double-headed self-acting pistons passing through them."

203. For an *Improvement in Revolving Last Holders;* Benjamin Marshall, Philadelphia, Pennsylvania.

"The object of my invention is to meet the demands for such an article at the present day as will enable mechanics engaged in the manufacture of boots and shoes, to perform their work with greater ease and facility, than by any other means now known or used to accomplish the said object."

Claim.—"1st, The screw and nut, in combination with the inclined plane, for the purpose of raising and lowering the toe-rest, and moving it back and forth. 2d, The combined arrangement of the crank or eccentric, with the revolving shaft, and the attachment of the elastic band, or its equivalent, at the waist, and at the set screw."

204. For an *Improvement in Securing and Guiding the Boxes of Oil Presses;* Wm. W. Marsh, Jacksonville, Illinois.

Claim.—"The employment upon the upper sides of the trusses of longitudinal guides, of such form that while they serve to conduct the boxes to and from the press, and to confine the hinged side against the outward pressure, they also serve to connect the trusses with the boxes."

205. For an *Improved Mode of Constructing Photographic Baths and Pans;* George Mathiot, Washington, District of Columbia.

Claim.—"To construct the baths and vessels for photographic use of an impervious substance, formed by the combination of a cement with an earthy matter, or its equivalent; and also to form the bath, or other vessel, by first forming the vessel of unglazed pottery, or its equivalent, and making the pottery impervious by saturating it with wax, gum, balsam, resin, pitch, stearine or siccative oil, or the equivalent for any one of these."

206. For an *Improvement in Metallic Canisters for Putting up Paints, &c.;* John W. Masury, Brooklyn, New York.

"The nature of my invention consists in the construction of a metallic vessel, with a sliding and revolving bail or handle, in such a style that it shall or may be substituted for wooden kegs, in the packing for sale or transportation of whole lead, zinc, and other paints."

Claim.—"The use of metallic cans for putting up paint, or other substances of any known form, with ears attached thereto, through which a wire bail may be passed, in such a manner as not to interfere with the packing of the cans, and to render it at once a package for transporting the paint, and a convenient and useful pot or pail, out of which to use the same, with a removable cover secured to the can."

207. For an *Improvement in Cop Tubes;* John Marland and Earlsworth Crocket, Lawrence, Massachusetts.

Claim.—"A cop tube formed of gutta percha."

208. For an *Improvement in Sails and Rigging of Vessels;* George T. May, Tompkinsville, New York.

Claim.—"The use of the self-supporting 'set' of masts, whether the same is composed of two or more masts, they being stayed and sustained by rigging, whose spread at the line of the deck shall not exceed the lines of the distance between the forward part of the pivot mast, and the forward part of the spring mast of the set."

209. For an *Improvement in Washing Machines;* Josiah Mayes, Cohoes, New York.

"This invention consists in the peculiar manner of arranging beaded strips upon the bottom of the tub and the face of the rubber, whereby the clothes will be subjected to a more perfect rubbing action than in the usual machine of this kind."

Claim.—"Attaching the beaded strips to the bottom of the tub and the face of the rubber."

210. For an *Improvement in Tempering Steel Plates;* Henry A. Seymour, Bristol, Connecticut.

Claim.—"The employment of the perforated plates and water cooling boxes."

211. For an *Improvement in Bomb Lances;* Rufus Sibley, Greenville, Connecticut.

Claim.—"Causing a bomb lance or projectile to take the wings that are to guide it through the air or water, from the muzzle of the gun from which it is discharged. Also, sloping the nozzle of the gun so that the wings may come back and close down to the barrel."

212. For an *Improved Excavator;* Samuel W. Soule, St. Louis, Missouri.

Claim.—"The frame, lever, lugs, rod, and pins or lugs, and their projection, or their equivalents, for the purpose of mechanically operating a scraper."

213. For an *Improved Machine for Tenoning Blind Slats;* La Fayette Stevens, Elmira, New York.

"The nature of my invention consists in improvements in the mandrel head and sliding table and gauge, for regulating the length of the tenon to be cut, and the use of a spur for cutting off the end of the tenon."

Claim.—"The movable and reversible gauge, in combination with the sliding table, arranged and operating in connexion with the mandrel head as made, and cutters and spur."

214. For an *Improvement in Self-adjusting Sack-holders;* Augustus Stoner, Mount Joy, Pennsylvania.

"The nature of my invention consists in supplying the place of a hand, so that a farmer, or others, can fill up bags without an assistant."

Claim.—"The spring and the adjustable base, by means of the screw and burr, and piece and hopper."

215. For an *Improved Mode of Constructing Letters for Signs, &c.;* Thomas Motley, Brooklyn, New York.

Claim.—"The new manufacture of frame or skeleton letters, that is, the outline of each letter or numeral is formed of a skeleton frame, open both front and back, or entirely through."

216. For an *Improved Wind-Mill;* Rufus Nutting, Randolph, Vermont.

Claim.—"The construction of a horizontal wind power, with a regulator or clasp operated by centrifugal force, which shall regulate the amount of surface of wing or sail opened to the wind. Also, an arrangement by which the regulator or clasp may be conveniently set at any time by the operator in such position as to prevent the wings from opening too far."

217. For an *Improved Method of Setting Head Blocks of Saw-Mills;* Ira Robbins, Unityville, Pennsylvania.

Claim.—"The combination of the lever catch, springs, cords, weight, stud, and lever, in connexion with the lever."

218. For an *Improved Machine for Planing Hoops;* Thaddeus S. Scoville, Elmira, New York.

Claim.—"The employment of a concave guide arranged with a hinged portion immediately before the cutters, which is held in place by a spring having less pressing force than the counter gauge roller, in combination with said gauge roller, or its equivalent."

219. For an *Improvement in Machinery for Winding Wadding;* Thomas Thompson, Niverville, New York.

Claim.—"The apparatus for removing the full roller, and supplying or depositing the empty roller, or the equivalent thereof. Also, the devices covered by the first claim, or their equivalents, in combination with the rollers arranged to divide or break the wadding or other material."

220. For an *Improvement in Railroad Chair Machines;* Corydon Winch, Jersey City, New Jersey.

Claim.—"The two bending and upsetting arms or bars, having their upper surfaces

made inclined, and provided with ledges or flanches at their inner edges, the bars being operated or moved so as to both bend and upset the lips, and thereby increase the thickness and consequently the strength of the lips where most required, viz: at the junction of the lips with the plate or base of the chair."

221. For an *Improvement in Skates;* John A. Winslow, Roxbury, Massachusetts.

Claim.—"The application of a second metal runner to the skate, which being placed on the bottom outside of the central line of axis, and the runner in the ordinary skate which lies along that line, removed to a correspondent position on the other side, completes the improvement."

222. For an *Improvement in Washing Machines;* Henry D. Young, Junius, N. Y.

"The nature of my invention relates to the peculiar method of constructing my washing rubber, and to the manner of tightening the apron on which the clothes are placed to be washed, and also of the manner of driving the washing rubber and apron."

Claim.—"The mode of operating the apron to give its surface a slower motion than the surface of the rubber, in combination with the shaft and apron, the side plate and hook, constructed and operated."

223. For an *Improvement in Purifying Oils;* Halvor Halvorson, Cambridge, Assignor to self, Edward H. Baker, J. F. Anthearu, and W. Tracy Eustis, Boston, Mass.

"The nature of my invention or discovery consists in the separation of the solid from the liquid constituents of fat by certain chemical means."

Claim.—"The employment of alcoholic solutions of alkali."

224. For an *Improvement in Anchor Trippers:* John B. Holmes, Assignor to self and John R. Pratt, City of New York.

Claim.—"The combination of the thread or screw working in a spiral groove or nut with the shaft or bolt, whereby I am enabled to relieve the chain, and trip the anchor at an instant."

225. For an *Improved Method of Operating the Chisels of Mortising Machines;* Moses Marshall, Assignor to self and Russell Dyer, Lowell, Mass.

Claim.—"The projection on the pawl, so constructed and arranged as to press back the bolt when moved in one direction, and release the collar, so that it may be turned by the pawl to reverse the chisel, and also that it, the projection, will pass outside the pin when moved in the other direction. Also, the slotted lever, chain, and lever, or their equivalent, so constructed and arranged as to turn the collar, and reverse the chisel."

226. For an *Improvement in Machines for Making Paper Bags;* Benjamin F. Rice, Assignor to Benjamin R. Smith and Charles H. Morgan, Clinton, Mass.

Claim.—"A combination or machine composed of machinery for bending a strip of paper around a former and into a tubular form, so that one edge may be lapped over the other, machinery for pasting such edges, or one of them, and closing or pressing them together, and machinery for cutting the tube crosswise. Also, the combination of machinery for bending a strip of paper around a former and into a tubular shape, so that one edge may be lapped over the other, machinery for pasting such edges, or one of them, and pressing them together, machinery for cutting the tube slantwise, while it is on the former or holder, and machinery for pasting or cementing the said tube near its front end, and bending or lapping the end of the tube on the cemented part, so as to form the bottom of the bag, and discharge said bag from the machine. Also, arranging the pitch line of the feeding gear in or about in the prolongation of the axis of the shaft of its crank, whereby we obtain intermittent and variable motions of the paper. Also, arranging and operating the cutting knife with respect to the former, so as to cause said knife to cut obliquely across the end of the former, and through the tube of paper. Also, the combination of the paster, and bending and discharging rollers, or their equivalent, the whole being made to operate together. Also, combining with the rollers the mouth bars or scrapers. Also, the improved construction of the cutting knife, viz: with a serrated edge."

227. For an *Improvement in Gauges for Casks;* John W. Cochran, City of N. York.

Claim.—"1st, The arrangement of the sliding plungers and set screws in relation to the connecting rods and measuring arms, by which I am enabled to work each arm independent from the other, and gauge casks or vessels, whether the bung hole is in the centre, in the head, or elsewhere. 2d, Making the measuring arm adjustable."

228. For an *Improved Machine for Splitting Wood;* Waterman L. Ormsby, Jersey City, New Jersey.

Claim.—"1st, The arrangement of the chisels in broken or serrated, and in diagonal lines, according to the nature of the wood to be split. 2d, The arrangement by which the apices of one row do not coincide, but alternate with those of an opposite row. 3d, The feeding apparatus and clamp, inclined as represented, by which sticks put into the feeding boxes require no further attention or handling till they drop as kindling wood from the splitting chisels. 4th, The combination of the feeding, sawing, and splitting apparatus, by which greater economy of time and power in preparing kindling wood is achieved than has been hitherto attained. 5th, The combination of the guide grooves in the flanch of the hopper, thereby avoiding the introduction of separate guide plates for the chisels."

Additional Improvements.

1. For an *Improved Filter;* David N. B. Coffin, Jr., Newton Centre, Mass.; patented Sept. 2, 1856; additional dated April 14, 1857.

Claim.—"1st, So constructing that part of the filter to which the filtering medium is attached, and providing it with a seat in the case, that it may be raised from said seat or turned upon it so that the water shall be free to pass in from the faucet, through and around the filtering diaphragm, in such manner as to wash away the impurities from the surface of the diaphragm; also, to relieve the force of the stream of water when drawn without filtering. 2d, In combination with the ring, the flanch for holding in their place the additional layes. 3d, The grooves on the outer surface, in combination with the ring, whether separate or continuous, like the thread of a screw, with or without a corresponding inside screw formed in the ring for greater certainty in holding the diaphragm, also the rebate, so that the ring may reach a little below the largest part."

2. For an *Improvement in Safety Hatches for Ware-houses;* William H. Thompson and Eustis P. Morgan, Biddeford, Maine; patented June 24, 1856; additional dated April 14, 1857.

Claim.—"The opening and closing of vertical doors attached to the tube or box of an elevator, by means of the action of a traversing car or platform, and its attachments."

Re-Issues.

1. For an *Improved Portable Steam Cross-cut Sawing Machine;* Samuel R. Wilmot, Watertown, Connecticut; patented August 14, 1855; re-issued April 7, 1857.

Claim.—"The combination of a saw, and a direct-acting engine for driving it, with an apparatus for securing the whole to the object to be sawed, in such a manner that the latter forms the support or basis by which the steam cylinder is maintained in the proper position."

2. For *Improved Carpenters' Gauges;* Joel Bryant, Brooklyn, New York; patented August 19, 1856; re-issued April 14, 1857.

Claim.—"The invention and exclusive use of point holders, or holders for the points, markers or cutters of gauges and instruments equivalent thereto, irrespective of any particular or definite form or kind of gauge, and irrespective of any definite form or kind of holder, means or contrivances, having a screw thread cut within the same, and corresponding with a screw thread cut upon the said points, markers, or cutters, so as that the said points, markers, or cutters, are operated within the said holders, to be raised or lowered through the instrumentality of the said screw threads within the said holders, and upon the said points, markers, or cutters, of the said gauges, or instruments equivalent thereto."

3. For an *Improvement in Reaping Machines;* Obed Hussey, Baltimore, Maryland; patented August 7, 1847; re-issued April 14, 1857.

Claim.—"The combination of a vibrating scalloped cutter, the indentations of whose edge act as a series of mooring shear blades, with slotted guard fingers, the sides of which act as a corresponding series of fixed shear blades, the parts of such fingers forming the slot, being connected at the front ends only, leaving the rear of the slot open and free for the escape of material that would otherwise clog the cutter."

4. For an *Improvement in Reaping Machines;* Obed Hussey, Baltimore, Maryland; patented August 7, 1847; re-issued April 14, 1857.

Claim.—"The improved beveling of the edges of the blades of scalloped sickles."

5. For an *Improvement in Reaping Machines;* Obed Hussey, Baltimore, Maryland.

Claim.—"The combination of a slot formed between the long and short parts of the guard finger, with an opening in the rear of the short part."

6. For an *Improvement in Sewing Machines;* Joseph P. Martin, Philadelphia, Pennsylvania, Assignor of John A. Bradshaw, Lowell, Massachusetts; patented Nov. 28, 1848; re-issued April 14, 1857.

Claim.—"Regulating the tension of the thread after it has been unwound from the bobbin by means of apertures and bars, within, upon, or through the thread case, either separate or combined, or by any equivalent means, when said means are within, upon, or form part of the bobbin case itself. Also, regulating the tension of the shuttle thread in the act of leaving the bobbin by a combination of one or more screws with a spring or any yielding or elastic substances, or any equivalent devices for producing the same effect."

7. For an *Improvement in Sewing Machines;* Joseph P. Martin, Philadelphia, Pa., Assignee of John A. Bradshaw, Lowell, Mass.; patented Nov. 28, 1848; re-issued April 14, 1857.

Claim.—"The covered shuttle to be used as a sewing machine, or in other words, constructing that portion of the bobbin case which comes in contact with the top, cylindrical, or in any other form which does not present edges in its transverse sections."

8. For an *Improvement in Looms;* Warren W. Dutcher, Milford, Mass.; patented June 27, 1846; re-issued April 21, 1857.

Claim.—"Supporting the way staff at its lower end, so that it may slide longitudinally, in connexion with supporting it in other respects by a joint link, or its equivalent, applied so as to cause that part of the staff which strikes the shuttle to move in a line parallel or about parallel to the race beam. Also, connecting the lower end of the two staffs below their fulcra, by means of a spring having an intermittent action for drawing them back, in combination with the application of a positive motion above for driving the shuttle, whereby the returning staff aids in arresting the momentum of the shuttle."

9. For an *Improvement in Refrigerators;* D. W. C. Sandford, St. Louis, Missouri; patented Nov. 13, 1855; re-issued April 21, 1857.

Claim.—"The employment of an open bottom ice-box, or equivalent thereof, in combination with a dividing partition open above and below, so placed that by means of self-operating internal circulation, the whole of the contained air shall be kept in motion, and caused to revolve around this partition in currents, moving downwards only on one side of this partition, and upwards only on the other side, when the same is combined with a chamber for the refrigeration of food or provisions, placed directly under said ice-box. Also, placing shelves of fixtures for holding articles to be refrigerated, or the articles themselves, in the descending current directly under an open bottom ice-box, in combination with a dividing partition open above and below. Also, in combination with said shelves or fixtures so placed, constructing the open bottom of the ice-box, in such a manner that the air may pass freely down through the same, and fall directly from the ice upon the articles to be refrigerated, while at the same time the drip of the water is prevented."

10. For an *Improved Hinge for Picture Cases;* A. P. Critchlow & Co., Assignees of Alfred P. Critchlow, Florence, Massachusetts; patented October 14, 1856; re-issued April 21, 1857.

Claim.—"My improvement in the application of a hinge of a daguerreotype or picture case moulded of a plastic material, or made of a flanchible substance or substances, such being made with each of its leaves being bent twice, and so applied to the halves of the box, that it may not only embrace two contiguous sides of such halves, and be independent thereof, or not have any tenon or projection to enter the same, but may extend or lap over and be fastened to the top and bottom plates of said box."

11. For an *Improvement in Seed Drills;* James Selby, Lancaster, Ohio; patented June 19, 1855; re-issued April 21, 1857.

Claim.—"Regulating at pleasure the quantity of seed discharged by means of the transverse slides, or their equivalent."

12. For an *Improved Saw-mill for Re-sawing Boards and other lumber;* Pearson Crosby, Fredonia, New York; patented Nov. 3, 1841; re-issued March 10, 1849; extended October 30, 1855; re-re-issued April 28, 1857.

Claim.—"The mode of operation of gauging, guiding, and presenting boards to the action of a saw, which mode of operation results from combining with a slitting saw the mechanism for gauging and guiding one face of the boards, and the mechanism for making a self-adjusting pressure on the opposite face of the boards, so that the boards will be clamped between the two said mechanisms on opposite faces, and immediately in front of the cutting edge of the saw, so as to prevent the gauged face of the boards however warped or bent they may be, in a plane parallel with the plane of the saw. Also, in combination with a slitting saw, and the arrangement of the gauge and pressure rollers connecting the said gauge and pressure rollers with the mechanism from which they derive motion by means of universal joints. Also, the method of hanging and straining the saw, by the combination of the three stirrups at the ends of the saw."

13. For an *Improvement in Gas Burners;* Charles H. Johnson, Boston, Mass.; patented June 26, 1855; additional March 18, 1856; re-issued April 28, 1857.

Claim.—"Elevating the orifice of injection above the base of the burner by means of a cone, or its equivalent, raised on said base, and into the chamber of the burner up into the distributor, or among its wires, in order that advantages may be attained."

DESIGNS.

1. For *Iron Railings;* Robert Wood, Phliadelphia, Pennsylvania; dated April 7, 1857.

Claim.—"The form of all the parts."

2. For *the Plates of Stoves;* A. C. Barstow, Providence, Rhode Island; dated April 14, 1857.

Claim.—"The moulding and ornamental raised figures."

3. For *Clock Cases;* Elias Ingraham, Bristol, Connecticut; dated April 14, 1857.

Claim.—"The case, with a wood circular sash to the dial, in combination with the square top case. Also, the carved enrichment on the glass of the tablet."

4. For *Clock Case Fronts;* Chauncey Jerome, New Haven, Connecticut; dated April 14, 1857.

Claim.—"The base pilasters on the jamb, posts, cap, plate, panel, pilasters, and door."

5. For *Plates of a Cooking Stove;* N. S. Vedder, Assignor to Smith & Sheldon, Troy, New York; dated April 14, 1857.

Claim.—"The design for the lower front plate, foot, and doors."

MAY 5.

1. For an *Improvement in Sewing Machines;* Bryan Atwater, Berlin, Conn.

"The arrangement by which I am enabled to keep the loop of the needle thread positively in position by guides alone without the necessity of introducing a looper or other device into the loop, or making the loop pass round a hook or fixed shuttle."

Claim.—"1st, The arrangement of guides for forming the loop from the slack of the needle thread, and directing the same by an external operation to a position for the needle to pass through it, consisting of a stationary guide piece, a stationary notched plate or edge, and two stationary guides arranged in proper relation to each other, and to the needle and the cloth, or other material to be sewed, and employed in connexion with a proper feeding movement of the cloth or material, and in combination with the said contrivance, the guide plate with its lip. 2d, Though I do not claim the dog, operating in connexion with an elastic foot piece on the face of the cloth, as in the machine of T. J. W. Robertson, to produce the feeding movement of the cloth, or other material to be sewed, I claim the attachment of the dog to a lever, arranged and operated upon by a wiper on the driving shaft to produce a quick or sudden feeding movement of the cloth or other material, which shall at the same time aid in throwing the loop in the path of the needle."

2. For an *Improvement in Screw Cutting Machines;* Wm. N. Adams, Olmsted, O.

Claim.—"The construction of the branched body, the disk, sliding fulcrums, levers, and adjustable releasing screw, combined in such a manner as to gauge the size of screw and depth of screw thread, and to release the screw as soon as cut to a determinate extent."

3. For an *Improvement in Stuffing Boxes;* N. R. Bates, City of New York.

Claim.—"The combination and arrangement of the plate with the wires surrounding it, and the screw-rods and nuts, for the purpose of compressing evenly around the piston the packing as it wears."

4. For an *Improvement in Looms for Weaving Pile Fabrics;* Erastus B. Bigelow, Boston, Massachusetts.

Claim.—"Operating the pile wires by a vibrating staff controlled by a parallel motion. Also, the method of constructing and organizing the hook and carrier for operating the pile wires. Also, in combination with the aforesaid hook and carrier, a box or holder for holding the pile wires in position, and suitably guiding said hook to act thereon."

5. For an *Improved Machine for Cutting Veneers;* Gilbert Bishop, City of N. York.

"The nature of my invention consists in so arranging the log and its carriage, the knife and its bearings and gearing, and the driving and feed machinery, that any sized log may be cut, and the position of the log easily adapted and changed as required, to the grain of the wood, and giving to the knife a long continuous rectilinear cut or draw, presenting a new edge to the wood so as to cut the veneers smoothly, and uniformly clear through the log, and in sharpening and giving a fresh edge to the knife by its own movement at each stroke or cut of the knife."

Claim.—"1st, The arrangement of the knife suspended between the upright frame pieces, and at right angles to the log, and giving it a long continuous drawing cut across the log, whatever may be the width of the log by means of screws. 2d, The horizontal grooved and slotted plate or knife bed attached to the sliding plates, held and guided between the uprights above named, and carrying, supporting, and strengthening the knife in its whole length, and at the same time allowing it a vertical movement for feeding it to the log as required. 3d, The arrangement of shaft, the ratchet wheel, the slotted burr, and connecting rod, the vibrating bent lever and star wheel, operating and connecting together for the purpose of giving motion to the feed screws."

6. For an *Improved Adjustable Pole for Carriages;* Sherlock H. Bishop, Orange, Connecticut.

"My improvement consists in constructing the braces of the pole with joints, and the arch piece with slots, and securing the braces to the arch-piece by double adjustable attachments."

Claim.—"The method of adjusting the braces by means of the joints, slots, and eye-bolts, when the whole is constructed, arranged, and made to operate."

7. For an *Improvement in Boats for Duck Shooting;* Robert Bogle, Rock Hall, Md.

Claim.—"In combination with the hull, the openings therein and leggings attached, so that the gunner may propel his boat."

8. For an *Improvement in the Picker Motion for Looms;* Samuel Boorn, Lowell, Massachusetts.

Claim.—"Arranging the centralizer and its mortise, with the picker staff and its rocker, so as to operate therewith."

9. For an *Improvement in Machines for Printing Subscribers' Names on Newspapers;* Stephen D. Carpenter, Madison, Wisconsin.

"The nature of my invention consists in a compound cylinder on which the type for printing the names of subscribers is placed, the cylinder having a sliding and revolving movement for bringing the name required directly under the press or platen."

Claim.—"1st, The construction of the cylinder made in sections with the flanches, to which india-rubber or any flexible material is secured for receiving the type, which type are set on the face of the cylinder in columns. 2d, The said cylinder, in combination with the platen. 3d, The combination of said cylinder with the devices, whereby it is rotated."

10. For an *Improvement in Surgical Splint Apparatus;* J. H. H. and Wm. J. Burge, Brooklyn, New York.

Claim.—"The combination of the pad straps with the platform and rod, which combination is intended to confine the counter extending pressure as much as possible to the tuberosities of the Ischia. Also, the rod as a means of supporting the fractured limb, only in connexion with the employment of extension and counter-extension."

11. For an *Improvement in Swells for Melodeons, &c.;* Jeremiah Carhart, City of New York.

"This improvement consists in providing the 'swell' of a melodeon, or other instrument of similar character, with one or more valves, which can be opened when the 'swell' is closed for the purpose of graduating the tone of the whole or any portion of the instrument. It further consists in certain mechanical means of operating the said valve, by which it can be opened and closed, either while the swell is closed or while it is opened."

Claim.—"1st, Providing the swell with a number of holes, and fitting the same with a valve or valves, for the purpose of graduating the tone of a portion or the whole of the instrument when the swell is closed. 2d, The mechanism for operating the swell valve either while the swell is open or closed, consisting of the upright shaft with its lever and arm, and the flexible rod."

12. For an *Improvement in Nut Machines;* Richard H. Cole, St. Louis, Missouri.

Claim.—"The application of the spring to the sliding punch plates."

13. For an *Improved Vault Cover;* John B. Cornell, City of New York.

Claim.—"Arranging the respective glasses or tiers of glasses in an illuminating vault cover in inclined positions to be the straight base of said cover."

14. For an *Improvement in Vault Covers;* John B. Cornell, City of New York.

Claim.—"Combining a series of gutters with the under surface of an illuminating vault cover."

15. For an *Improvement in Metal Packed Pistons for Steam Engines;* George W. Cotton, St. Louis, Missouri.

"My improvement has reference to that class of piston heads in which a single split or divided metallic ring is made to form the packing."

Claim.—"The arrangement for operating together on a single ring packing, of the wedge with its sliding block and radial stretchers, spiral springs, and inner sliding steps or blocks. Also, forming the joint or break of the single ring packing, with overlapping tongues and wedge of less depth than the packing and fitting loosely between the beveled ends of the packing and the tongues, at the top and bottom, or opposite edges of the packing ring."

16. For an *Improved Portable Field Fence;* Ezra Cole, Fairhaven, Michigan.

Claim.—"The post for use in connexion with picket or panel sections of a fence, formed of two thin planks, one of said planks being arranged on the one side of a transverse sill, and the other on the opposite side of the same, and one bearing, when the sections are locked together against the inner face of one of the sections, and the other against the outer face of the adjoining section."

17. For an *Improved Method of Opening and Closing Gates by approaching Vehicles;* Solomon Cole, Rochester, New York.

Claim.—"The arrangement of levers and ways or rails and tilting pins, whereby the gate is not only opened and kept open, but the tilting pins on the other side of the gate are placed in the proper position to tilt the rails and close the gate on the passage of a vehicle."

18. For an *Improvement in Rotary Brick Machines;* George Crangle, Philadelphia, Pennsylvania.

Claim.—"A cylinder without movable bottoms to the moulds, in combination with a bed-piece fixed to the frame of the machine, so as to serve the purpose of said bottoms, the said cylinder and bed-piece being constructed, arranged, combined, and operated together."

19. For an *Improved Door Bolt;* Jeremiah M. Crosby, Norwalk, Ohio.

Claim.—"The arrangement of the bolt rod and the cam or eccentric."

20. For an *Improvement in Reaping and Mowing Machines;* Charles Crook, New Hope, Pennsylvania.

"The nature of my invention consists in employing an adjustable pinion between and in combination with the teeth of the internally geared driving wheel, and the teeth of a spur-wheel on the axle of the driving-wheel, whereby the machine can be quickly geared so as to be adapted either for mowing grass or cutting grain."

Claim.—"Operating the cutters of combined reaping and mowing machines by means of the intermediate pinion, in combination with the internally geared driving-wheel, and the spur-wheel on the driving-wheel shaft, when the same are constructed and arranged in relation to each other."

21. For an *Improved Omnibus Coffer;* Joseph T. Curtis, City of New York.

Claim.—"The application and employment of a movable transmitting coffer, in combination with omnibuses and other vehicles."

22. For an *Improvement in Straw Cutters;* E. G. Cushing, Dryden, New York.

"My invention consists in giving the box to which the 'leger' blade or cutter is attached, and within which the feed rollers are placed, a vibratory movement, whereby a greater cutting angle and also a longer stroke is obtained, and the straw or stalks held or grasped firmly in position, while being acted upon by the cutters, and a simple and adjustable feed motion also obtained."

Claim.—"1st, The disk wheel with cutter, one or more attached, in combination with the vibrating head or box in which the feed rollers are placed, and the 'leger' cutter attached, the above parts being arranged and operating conjointly. 2d, Operating the feed rollers by means of the ratchet wheel and pawl, when used in connexion with the vibrating head or box."

23. For an *Improvement in Heating Feed-water Apparatus for Locomotives;* Peter S. Ebbert, Chicago, Illinois.

Claim.—"In combination with the chamber enclosing the heating pipes, the inlet and exit pipes, so arranged as to cause the steam to circulate over, around, or through the heating pipes before it escapes."

24. For an *Improvement in Ice Cutting Attachments to Vessels;* Thomas Estlack, Philadelphia, Pennsylvania.

Claim.—"1st, The cutters formed of the teeth, and attached to the inclined bars, which are pivoted to the share. 2d, The share when applied and secured to the bow of the vessel by the chains, and used in connexion with the cutters."

25. For an *Improved Method of Uniting and Sustaining the Panels of Portable Field Fences;* Isaac D. Garlick, Lyons, New York.

Claim.—"My improved portable field fence."

26. For an *Improvement in Ploughs;* Thomas C. Garlington, La Fayette, Ala.

Claim.—"The combination of headed slide, strap, brace, and key, for performing the double function of bracing the beam and stock, and securing the mould board to the stock."

27. For an *Improvement in the Construction of Ploughs;* Jackson Gorham, Bairdstown, Georgia.

Claim.—"The foot piece having a box at its upper end, and the two flanches at its lower end, for the purpose of securing the foot piece to the beam, and the lower end of the brace to the foot piece."

28. For an *Improvement in Locomotive Engines;* Horace Gray, Boston, Mass.

Claim.—"Constructing locomotive steam engines with two or more boilers, or with one boiler having two or more separate fire boxes or furnaces connected."

29. For an *Improved Process for Purifying Gutta-Percha;* Robert Haering, City of New York.

Claim.—"The method of purifying gutta-percha by means of the ether and alkali."

30. For an *Improvement in means for directing the Exhaust of Locomotives;* Robert Hale, Roxbury, Massachusetts.

Claim.—"The device for the purpose of leading off a portion of the exhaust steam

to heat the feed-water, without interrupting or changing the direction of that portion of the exhaust not so employed."

31. For an *Improvement in Chain Pumps;* James Harrison, Jr., City of N. York.

Claim.—"The use, in combination with the buckets, of a lifting cord composed of coiled wire."

32. For a *Violin Attachment;* Andrew Hett, Augusta, Georgia.

"The nature of my invention consists in providing an ordinary violin with four additional strings, in such a manner as to vibrate all the sharp and flat tones."

Claim.—"The application of the vibrating strings to violins, violoncellos, and other similar instruments."

33. For an *Improved Adjustable Bed and Gauge to Regulate Tenoning;* D. Hodges, Suffolk, Virginia.

Claim.—"The reversible bed with adjustable end guide, stationary guide, and devices for securing the lumber."

34. For an *Improvement in Brick Machines;* Joseph W. Jayne, Sandusky, Ohio.

Claim.—"1st, The radial, sliding, and revolving charges, in combination with the eccentric slot or groove, and horizontal mould wheel. 2d, The combination of the peculiarly shaped yoke, with the mould wheel, and the sliding and revolving charges, the whole being constructed and operating conjointly."

35. For an *Improvement in Cotton Seed Planters;* Henry L. Justice and John H. Galbreath, Goodlettsville, Tennessee.

Claim.—"The combination of a rag-wheel having adjustable arms, with the movable hopper of a cotton seed planter."

36. For an *Improvement in Transmitting Motion;* Mathaus Kaefer, Alexandria, Pennsylvania.

Claim.—"Hanging a loaded fly or balance wheel on a traveling carriage, so that said carriage shall yield to the momentum of the fly-wheel, as it passes the dead points."

37. For an *Improvement in Machines for Cutting and Binding Grain;* Hiram Kellogg, McHenry, Illinois.

Claim.—"The compresser device formed of the grip rods, standard, and springs, in combination with striker."

38. For an *Improvement in Machines for Turning the Edges of Cloth;* John P. Marston, Charlestown, Massachusetts.

Claim.—"The combination of the guides and roller."

39. For an *Improvement in Pocket Safes and Fastenings;* George R. McIlroy, Covington, Kentucky.

Claim.—"Holding the shank of the button between the horizontal spring and the cam on the vertical spring, so that by drawing and letting go the rod, the said shank will be raised up by the horizontal spring, and the cam passing under it throw it out of the hasp part; and this I claim whether one, two, or more buttons be used, so long as the series is thrown out by one operation of the rod."

40. For an *Improved Self-Reversing Feed Motion for Sawing Mills;* Daniel and Angus A. Methven, Wooster, Ohio.

Claim.—"The arrangement of the inclined planes, the connecting rods, and rock shafts, the pawls, and the double ratchet-wheels, in combination with the double toothed saw."

41. For an *Improvement in Machinery for Napping Cloth;* John C. Miller, Starucca, Pennsylvania, and Charles N. Tyler, Washington, D. C.

Claim.—"1st, The combination and arrangement of two or more napping cylinders, 2d, The teazling disks, or their equivalents, in combination with the cylinders. 3d, The method of securing the gig rods to the cylinders."

42. For an *Improvement in Ships' Hawse Holes;* Robert R. Osgood, Assignor to Jason C. Osgood, Troy, New York.

Claim.—"Supporting a pulley on a rotating bed, and combining therewith a guide tube hinged on its axis for the rope to pass through."

43. For an *Improvement in Wrenches;* Charles Pinder, Lowell, Massachusetts.

Claim.—"Moving, holding, and releasing the movable jaw, by means of the double wedge or key, with its inclined planes operating against similar ones formed in the movable jaw, while the lower surface of this wedge comes in contact with the inclined plane in the groove formed in the wrench bar."

44. For an *Improvement in the Buckets of Automatic Weighing Machines;* Rufus Porter, Washington, D. C.

Claim.—"1st, The combination of the tripping rods with the valve plate and knuckle braces, whereby the movement of the valve gate (which is operated by means of the scale beams), causes the contents of the bucket to be discharged alternately. 2d, The knuckle braces, in combination with the trap doors, whereby the latter are spontaneously closed and fastened immediately after the grain is discharged."

45. For an *Improvement in Coupling for Shafting;* William and Coleman Sellers, Philadelphia, Pennsylvania.

Claim.—"The use of two conical sleeves within one external sleeve, when they are so arranged as to compress the ends of the coupled shafts separately, whether the shafts be of the same or different diameters. Also, bolting said conical sleeves together, or in any other mode whereby the bolts may serve as keys to prevent the internal cones from turning in the external sleeve."

46. For an *Improved Process for Preparing Green Sand Marl as a Fertilizer of Lands;* Charles Stearnes, City of New York.

Claim.—"Concentrating their fertilizing and stimulating properties by the previous separation of the useless matters of the marl, and disintegration of the green sand, and the superaddition of ammonia."

47. For an *Improved Piano-Forte Action;* Henry Steinway, City of New York.

Claim.—"The sliding post and spring, or its equivalent, applied in relation to the jack and key, to operate in combination with a block on the hammer shank."

48. For an *Improved Mode of Constructing Rollers or Cylinders for Printing Fabrics;* Richard F. Sturges, Birmingham, England; patented in England, October, 16, 1856.

Claim.—"Casting a thick tube of a hard and easily fusible metal or alloy in the interior of a tube of copper or alloy of copper."

49. For an *Improved Clothes Pounder;* Sardis Thompson, West Otis, Mass.

Claim.—"The bell-shaped cylinder, in combination with the piston, piston-rod, spring, and handle, or other equivalents, to produce the same effect, viz: the cleansing or washing clothes by agitating the liquid by the pressure of air."

50. For an *Improvement in "Ladies'" Skirts;* Helen C. Traphagen, City of New York.

Claim.—"The attachment of a series of air-tight tubes to the body of a skirt or petticoat, to expand and set out the skirt when the said tubes are filled with air."

51. For an *Improved Arrangement of Door Sill and Door Strip;* Henry Tryon Steuben, Pennsylvania.

Claim.—"The construction of my door strip in connexion with the sill, or any other construction substantially the same, and which will produce the same result."

52. For an *Improvement in Blind Fastenings;* Horace Vansands, Middletown, Conn.

Claim.—"The attaching of the blind hook by means of a screw or rivet between, and in the recess of the two shells or case."

53. For an *Improvement in Machines for Combing Wool;* Cullen Whipple, Providence, Rhode Island.

Claim.—"The combing machinery whereby the fibres after being fed into, or received amongst, teeth (set in a suitable surface), have their ends raised out from the teeth, and held by nippers, while the ends are cleaned—the cleaned ends of the fibres being then nipped and drawn among the teeth in order to clean the other ends, and also to separate this quantity of fibres from the other fibres amongst the teeth; the protruding ends are then deposited amidst the teeth in such manner that they overlap the ends of the

quantity of fibres which have been just previously similarly treated, thus admitting of the prepared or combed fibres being doffed or drawn off from the teeth in a continuous sliver."

54. For an *Improvement in Machines for Making India-Rubber Belting;* Robert Hale, Roxbury, Massachusetts.

Claim.—"The manufacture of machine belting by folding and cementing strips of india-rubber cloth by a series of mechanical devices. Also, the method of moistening the seam, and applying the india-rubber strips thereto. Also, the manner of applying the middle for a belt of three or more plys, by means of guides, the two being united."

55. For a *Varnish to Prepare Photographic Grounds for Wood Engravers;* Robert Price, Worcester, Massachusetts.

Claim.—"The varnish composed of asphaltum, varnish, lamp black, and ether, when the same is applied to the block by rubbing it into its pores."

56. For an *Improvement in Sleighs and Cutters;* Lewis B. Randall, Penn Yan, New York.

Claim.—"The parts designated by the letters."

57. For an *Improvement in Fire Arms;* John B. Read, Tuscaloosa, Alabama.

Claim.—"The providing the upper part of the powder space or chamber of fire arms with angular or wedge-shaped projections, to be forced into the rear of the projectile in the act of loading. Also, the form of ball cylindrical at or near its middle portion, with a slight excavation or recess in the inner and under side of cylindrical part, both ends of ball to be conoidal or conical."

58. For an *Improved Arrangement of Stair Steps;* Charles Robinson, Cambridgeport, Massachusetts.

Claim.—"Placing beneath each step a spring or springs, so as to give an elastic movement thereto in ascending and descending upon the stairs."

59. For an *Improvement in Close or Open Stoves;* Henry Seitz, St. Mary's, Va.

Claim.—"The arrangement in a grate, of the plates, supplementary grate bars, dust flue, air heating chambers, and passages."

60. For an *Improvement in Locks;* Alfred Williams and Edward P. Cummings, Philadelphia, Pennsylvania.

Claim.—"The use of the yoke, the levers, and the stop lever, the whole constructed, arranged, and operating in connexion with the disk."

61. For an *Improved Mode of Operating the Gate of Turbine Wheels;* L. M. Wright, Niagara Falls, New York.

Claim.—"I do not claim the parts separately, but their arrangement."

62. For an *Improved Mode of Securing Hubs to Axles;* Leonard J. Worden, Utica, New York.

"The object which I have in view in this invention, is to provide a fastening at the front or outer end of the skane, in which the skane and nut may be cast of a simple form to fit each other with as little fitting up as possible."

Claim.—"Making on the front end of the skane or bush, a neck of peculiar form, that is to say, having two or more parts of its periphery of a cylindrical shape, whilst the remaining parts are both cam-shaped and conical, when used in connexion with a nut whose internal periphery corresponds with the external periphery of the neck lock plate, or its equivalent."

63. For an *Improvement in Brick Machines;* James Hotchkiss and Wm. H. Schofield, Assignors to selves and Wm. R. King, Yellow Springs, Ohio.

Claim.—"The combination of the plungers with the sliding carriers and mould wheel, when the same are so constructed and arranged as to operate in relation to each other."

64. For an *Improved Cutter for Turning Cylindrical Wooden Boxes;* Henry Mellish, Walpole, New Hampshire, Assignor to Charles Pope, Brookline, Mass.

Claim.—"The cutting tools made with cutters or cutting edges, to cut and plane the box or box cover."

MECHANICS, PHYSICS, AND CHEMISTRY.

*The Photo-Galvanographic Process of Engraving.**

Light and electricity have been put into harness by Mr. Paul Pretsch, lately the manager of the Imperial Austrian Printing Office at Vienna, and trained to perform the united functions of the artist-draftsman and engraver.

The first steps of this photo-galvanographic process are similar to those adapted to the glass-plate photographer. The operator coats a glass plate with a gelatinous solution, suitably prepared with chemical ingredients sensitive to light. These compounds form the coating material, which is allowed to dry upon the glass or other plate which is coated with it. When dry, the coated plate is exposed to the light in a copying frame, in contact with the print or drawing which is to be copied. After exposure, the plate exhibits a faint picture on the smooth surface of the sensitive coating, and it is washed with certain solutions, when the whole image comes out in relief, whilst the tints of the original are still maintained. When sufficiently developed, this relievo plate is dried and moulded. The mould is prepared for electric conduction, placed in the electrotype battery, producing a thin copper-plate or matrix, which is used for producing finally the intaglio printing plate.

With this printing process there is no fear of fading, as the plate impressions are in ink, and the attention of an ordinary printer suffices to keep the pictures to the proper color.

We have seen some remarkable specimens, especially from Gothic buildings, and look for great things from the process. The Company, amongst other works, propose to publish, from photographic originals "The Cathedral Antiquities of the British Empire;"—the plates to be engraved by the Company's patent process, on a scale of great magnificence.

Wrought Iron Beams and Joists. † By W. Fairbairn, F. R. S., C. E.

Abstract of Report to the Board of Trade, on the Paris Universal Exhibition.

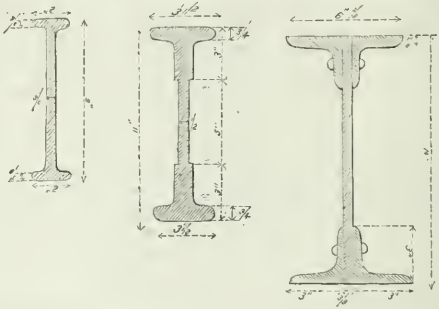
In the manufacture of wrought iron beams and joists the French have taken an undoubted lead; and the specimens exhibited from the Forge et Fonderie de Montataire and others, at the late Paris Universal Exhibition, indicated a degree of perfection which has not as yet been attained in this country. Some of the joists, of the sectional dimensions shown in the annexed sketch (fig. 1), were rolled 60 feet long, and another specimen of still greater dimensions, as at fig. 2, was rolled 40 feet long. These specimens, and several others of different sizes, showed how much has been done, and how much may yet be accomplished in this branch of manufacture; and we have yet to learn why the same facilities cannot be afforded for the introduction of this class of work direct from rolls by the iron makers of England and Scotland. If this description of beams were properly rolled and manufactured, it would effect a great saving in mechanical construction, and would, at the same

* From the London Builder, No. 728.

† From the Lond. Civ. Eng. and Arch. Journ., March, 1857.

time, produce much greater certainty in the strength of beams, by dispensing with the present system of joints, and the riveted angle-iron, which constitute at the present moment our defective mode of constructions, as shown in the section, (fig. 3.) It would introduce also into our present system of manufacture, a new and greatly enlarged branch of industry, adapted to all the requirements of the architect, the builder, and the engineer.

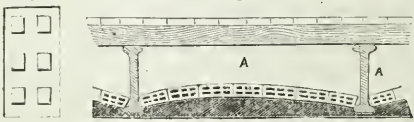
Fig. 1. Fig. 2. Fig. 3.



The introduction of this new description of beam, if properly prepared, would establish a new and important era in the history of constructive science, as it would supply architects and engineers with an article on which they might safely depend for durability and power of resistance to strain; which would not be liable to dry-rot, sap, or any of the destructive diseases to which timber is subject; and which would be free from oxidation when kept dry and imbedded in plaster. This is shown by the construction of floors, in constant use in Paris. Besides, a building so constructed possesses the advantages of being fire-proof, strong, and secure.

It may here be stated, that the floors of all the better class of houses in Paris are now built with iron joists, placed at distances varying from 2 feet to 2 ft. 6 ins. asunder. Some of these floors supported on iron joists are 30 feet wide. At about every 3 ft. 6 ins. cross tie rods are placed, on which rest slender wrought iron rods ½-inch square, three between each joist; these rods are run through perforated bricks of the annexed sectional form (fig. 4). These bricks are built in a slightly

Fig. 1. Fig. 5.



arched manner, and the space below them filled with plaster, forming a perfectly solid floor. Across these rods and arches, wooden sleepers are placed to receive the boarding for the floors, leaving a hollow space be-

tween each joist, as at A, A, (fig. 5.) In this description of floors there is every security from fire, and the plaster being a bad conductor of heat, equalizes the temperature of the room. The only objection, is the open space A, A, (fig. 5,) between the arches and the boarding, serving as a receptacle for vermin. This objection might be removed by divisions of plaster 6 inches thick carried across the floor, and in contact with the boards. This description of building is in general use in Paris and most other towns of France, and viewing it as a permanent fire-proof structure, I should earnestly recommend its adoption in this country.

In the manufacture of malleable iron beams in France, sufficient attention has not been paid to form, in order to attain the section of greatest strength. The French philosophers and engineers are fully aware of the experiments made in the year 1845, for investigating the strength and form of iron beams, in order to establish the principle on which the Britannia and Conway tubular bridges should be constructed.

The formulæ deduced from these experiments are well known in France, and up to the present time have been used for similar constructions. They proved that wrought iron beams followed a totally different law in their resistance to strain, to cast iron; that in wrought iron beams the area of the bottom flange requires to be little more than one-half that of the top; while in cast iron beams the area of the bottom flange should be *six* times that of the top flange. This difference arises from the great resistance which wrought iron offers to a tensile strain, and its comparatively inferior resistance to compression. Cast iron, on the other hand, possesses a high power of resistance to compression and defective resistance to tension.

The following table of resistances will show how the material should be distributed, in order to obtain the maximum of strength with the minimum or least required quantity of material:

The resisting power of—

	To tension, in tons.	To compression, in tons.
Wrought iron plates is	23	12
Copper,	16	3
Cast iron,	8	51

Fig. 6.

From the above it is evident, that to obtain the maximum strength in a wrought iron beam from the least quantity of material, the area of the top flange should be nearly double that of the bottom; but as this is difficult in practice, I submit the annexed form (fig. 6), as the nearest approach to a maximum sectional strength. It is desirable to make the top flange as broad as possible, for the purpose of giving the beam lateral strength, and in this form the useless material now given to the bottom flange would be saved.

In other descriptions of manufacture, such as railway bars, angle iron, T-iron, and other varieties, we are in advance of other nations, though in beams and joists, like those so extensively used in France, we are far from perfect.

*Solution of Quartz.**

The Australian papers just received from Melbourne report the discovery, by Count Dembinski, of a process by which quartz or silica is chemically dissolved, and all the gold, metallic oxides, and metals contained in it precipitated. His method is the following:—One part of quartz in small pieces is, together with two-and-a-half or three parts of carbonate of soda, brought to a red heat and melted. Cast iron tubes are, perhaps, the best vessels in which this process can be done. Silicate of soda is now formed, deliquescent in air, and perfectly soluble in cold water, the carbonic acid of the soda being, of course, given off by the reaction. This silicate of soda is dissolved in water, in wooden vessels, and thus left for a few hours, during which time the gold and all other foreign substances contained in the quartz are precipitated. After the precipitate has been formed, the solution of silicate of soda is, by means of a syphon, decanted into another wooden vessel, in which, by the inflation of carbonic acid, the soda is separated from the silicic acid, and regained as carbonate of soda. By decanting it again, and evaporating the water, it is made fit for another dissolving process. He obtains the carbonic acid, which is used for regenerating the soda, from the same fire which he makes use of in combining the quartz and soda. This he does by employing the well known centrifugal air-pump, and follows up in all particulars the method of Melsens in the decomposing of saccharate of lime. By inflating carbonic acid into the solution of silicate of soda, he separates the silicic acid from the soda. This latter remains in water, the silicic acid has been precipitated in the form of a transparent, nebulous, jelly-like substance, which cannot be separated from water by filtration. He now decants the solution of carbonate of soda, which, by means of evaporation, he obtains again as dry carbonate of soda. As such it can be made use of in further operations.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, June 18, 1857.

John C. Cresson, President, in the chair.

John F. Frazer, Treasurer.

John P. Murta, Recording Secretary, pro tem.

The minutes of the last meeting were read and approved.

Letters were read from the K. K. Geologischen Reichsanstalt, Vienna, Austria; Charles F. Loosey, Esq., City of New York; Regents of the University of the State of New York, Albany, N. Y.; and the Academy of Science, St. Louis, Missouri.

Donations to the Library were received from the K. K. Geologischen Reichsanstalt, and Alois Auer, Esq., Director of the Imperial Printing Department of Austria; the Osterreichischen Ingenieur-Vereines, and the Niederosterreichischen Gewerbe-Vereines, Vienna, Austria; The Mechanics' Institute of Tennessee, Nashville; The Metropolitan Mechanics' Institute, Washington, D. C.; The American Philosophical Society; The

* From the Lond. Mech. Mag., Jan., 1857.

Sunbury and Erie Railroad Co.; The Pennsylvania Institute; and Messrs. Ellwood Morris, Isaac S. Williams, and Wm. H. Jones, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement for the month of May was read.

The Board of Managers and Standing Committees reported their minutes.

The Board of Managers reported that they had elected Alois Auer, Esq., Director of the Imperial Printing Department of Austria, a corresponding member of the Institute.

Candidates for membership in the Institute (3) were proposed, and those proposed at the last meeting (3) were duly elected members.

It was announced that the President and the Recording Secretary of the Institute had been elected corresponding members of the K. K. Geologischen Reichsanstalt, in Vienna, Austria; when

On motion of Prof. Frazer, the Corresponding Secretary was instructed to return the thanks of the Institute to the K. K. Geologischen Reichsanstalt of Vienna, Austria, for electing the President and the Recording Secretary of the Institute, corresponding members of their Association.

A fork made of aluminum was exhibited to the meeting, which, having been left for a month in a jar of pickled walnuts, had lost the entire portion which had been immersed, and was much corroded in the other portions.

A piece of the cable intended for the Atlantic Telegraph was shown to the members. The conducting wires are of copper, seven in number, one being in the centre, with the others disposed around it radially, all being in contact; these are insulated by a coating of gutta percha, which is served, or closely wrapped, by tarred spun yarn, which is enveloped by eighteen strands, each composed of seven wires loosely twisted. These outer strands are intended to take the strains that may occur in the laying, or after, due to the weight of the cable itself, or the action of currents. About six miles of the cable will have the strands made of steel wire, of a strength competent to sustain about six tons; and will be the part laid first, as the greatest strains are naturally expected at the time when the cable is stretched in a comparatively horizontal line between the two receding vessels employed to lay it.

Mr. Richard L. Smith presented to the meeting his patent improvement in car brakes. This improvement consists in the employment of sliding rods situated below the axles, and extending the whole length of the car. The sliding rods are connected to bars passing between rollers on shafts, which have their bearings in hangers attached to the rubbers, which act on the top of the wheels. The bars which pass between the rollers are furnished with inclined planes, so arranged, that, on the said bars being pushed in one direction or the other by means of the sliding rods, the inclined planes will act on the lower rollers, and cause the rubbers to bear hard upon the wheels. The sliding rods are so connected to each other and to the brake bars, that they in nowise interfere with the motions of the trucks.

In order to operate the sliding rods of each car of the train suddenly to avoid collision, there is hung in front of the brake van or tender a lever with two arms, one having a pointed projection, and the other a

roller so arranged, that the lever may be depressed, and the pointed projection brought in contact with the ground, when the arms will, through the momentum of the cars, be suddenly driven back, until the projecting point is forced from contact with the ground by the action of the roller on the arm as a fulcrum. This movement of the arm, which is modified by a spring, is communicated by means of a rod to the sliding rods of the car, and so on through the whole train of cars simultaneously, thereby pressing the rubbers against the respective wheels.

In order to regulate the amount of movement of the jointed sliding bars, when the train is required to make an ordinary stoppage, or to prevent any movement whatever of the said rods, when the train descends an inclined plane, there is placed underneath the floor of the tender or brake van a bumper rod, which is so arranged that its end may be brought nearer to, or farther from, the bumper of the first car at pleasure. As the rubbers and brakes are supported directly by the axle, they do not in the least interfere with the action of the car springs, thus avoiding the unpleasant jarring so much felt from brakes in common use.

The subject of *the Joints of Railway Tracks*, coming up in order, pursuant to notice given at the last monthly meeting, the discussion was commenced by Ellwood Morris, C. E., who remarked :—

That notwithstanding the vast extension of railways, and the great improvements made in their rolling machinery, but little has been done for the track, and the plan of the "*permanent way*" (so-called,) has remained substantially the same for twenty years or more, though *now* in the process of modification, by many skilful engineers.

A great difficulty has always existed in forming the joints or connexions between the independent bars of iron, of which the tracks of railways are composed, and notwithstanding the very numerous plans proposed or tried for joints (several hundreds in number), we may truly say that no single plan of joint has yet commanded the general approbation of railroad men.

The joints of railways still form perhaps the most imperfect part of railway superstructure, and the selection of the best practical joint, under all the circumstances—a problem of great importance to railroads, —*yet remains a desideratum.*

To this subject we wish to draw your attention, and with the view of opening the discussion, *twenty-one* of the leading joints will now be referred to, and in such brief reference, many meritorious plans will necessarily be overlooked ; but it is to be hoped some of the members present may assist in the explanation, by bringing forward such others as they may think of use.

Notice of some of the Principal Joints.

1. *Cast Iron Chair by George Stephenson, C. E.*, (1829,) on stone blocks, rail secured by wrought iron wedge.*

2. *Cast Iron Chair of Robert Stephenson, C. E.*, on stone blocks, and upon wooden cross-ties, rail secured by a pin keyed through the chair.*

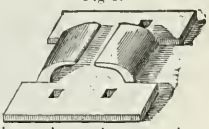
3. *Cast Iron Chair with wooden key*, first used by J. Locke, C. E., on the Grand Junction Railway,* and very generally adopted since.

* English Patents. Wood on Railroads. Breese's Railway Practice, &c.

4. *Norris's Cast Iron Chair*, (England,) cast upon the joints in place by means of a traveling cupola. This form of chair, which seems to negative all idea of expansion and contraction, is said to answer very well in some cases.*

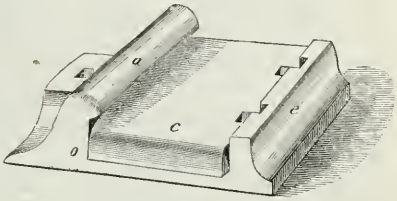
5. *American Wrought Iron Chairs*, commonly used in the United States, weighing from 7 to 10 lbs. each—being about 7 inches square on base, and $\frac{1}{2}$ to $\frac{3}{4}$-inch in thickness—the $\frac{1}{2}$ inch chair having proved too light. The $\frac{1}{2}$ inch chairs weigh 7 lbs., and the $\frac{3}{4}$-inch chairs 10 lbs. each. (See Fig. 1.)

Fig 1.



6. *Davis's Cast Iron Chair*, (figs. 2, 3, & 4,) with elastic seat. This is an open sided chair, with a flat piece of indian rubber placed under the joint, and kept in place by a wrought iron plate with the edges turned down. It is in successful use on some of the New England railroads, and is said to make a good joint—but certainly a yielding one.

Fig. 2.



DESCRIPTION OF FIGS. 2, 3, 4.—Fig. 2 shows the chair *a*, ready to receive the rail, which is to be notched on one side only—*c* being the boiler plate cap, over the rubber bearing. A plate of india rubber, *h*, $\frac{1}{4}$ inch thick, lies on the bottom of the chair, *o*, as shown in fig. 4, and is covered and confined by the wrought iron plate, with the ends turned down, as shown at *c*, figs. 2 and 3.

Fig. 3.

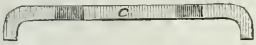


Fig. 4.

7. *Morley's divided Cast Iron Chair*, (figs. 5 and 6,) in two parts, connected by bolts under the rail. This is a recent invention, in the right direction.

Fig. 5.

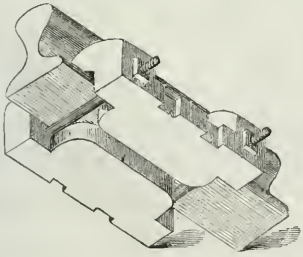


Fig. 6.

* English Patents. Wood on Railroads. Breese's Railway Practice, &c.

8. *Hewson's Cast Iron Chair*, (33½ lbs. weight,) of the kind used for 60 lb. rails, upon the Upper Schuylkill railroads. This is a close chair without keys, made to fit the base of the rail, and is crossed at the centre by a parting rod ½-inch square, against which the rail rests, and which keeps the rails in place longitudinally.

The following communication from Col. Hewson will show the wear of cast iron chairs in use.

TABLE—*Showing the number of Cast Iron Chairs renewed on the Reading Railroad from* 1849 *to* 1855 *inclusive, compiled from their Annual Reports:*

Year.	Tons of coal freight and passengers.	Tons of materials for use of road.	Total tons carried.	Number of chairs renewed.
1849	1,284,661	145,503	1,429,564	26,537
1850	1,586,230	157,450	1,743,680	27,292
1851	1,925,401	219,731	2,145,132	26,286
1852	1,910,954	181,217	2,122,171	19,742
1853	1,902,036	174,161	2,076,197	13,148
1854	2,394,972	187,591	2,582,563	13,385
1855	2,662,189	247,478	2,909.667	36,544
	13,695,843	1,313,131	15,008,974	163,234

As it is very seldom that chairs are renewed upon the sidings, I have estimated 106,400 upon the main tracks assumed at 200 miles, and 532 chairs to the mile, including branch to Philadelphia and tracks leading to wharves at Richmond, we find the following results—

That in the passage of 13,695,843 tons of 2000 lbs. upon the main tracks of the P. & R. R. R., 153 per cent. of their cast iron chairs have been replaced—at the rate of 22 per cent. per annum—and that 8,000,000 *of tons have destroyed the entire number of cast iron* joint fastenings on their main tracks.

This destruction by tonnage is fully confirmed by the experience of the roads under my charge, the record of which is shown in the following table—

STATEMENT—*Of the number of broken cast iron chairs for* 60 *lbs. rail replaced on the main tracks of the Port Carbon, Mill Creek and Schuylkill Valley Railroads, from January* 1*st*, 1853, *to December* 31*st*, 1856.

Name of road.	Tons of coal and freight 2240 lbs. to the ton from 1853 to 1856.	Number of chairs broken.	Per centage of whole number of chairs on main tracks.	Per cent'ge per annum.	Remarks.
Port Carbon R. R.	2,596,353	1233	44	11	563 chairs estimated to each mile of main track.
Mill Creek, "	2,087,267	1088	32	8	
Schuylkill Valley "	1,933,804	2172	30	7½	

Note.—That the Port Carbon Railroad is the terminus for the entire locomotive force used by the Reading Railroad in the transportation of coal.

The running of which, upon their tracks, has greatly increased their depreciation.

F. HEWSON, *Eng. Mt. C. & Pt. C.,*
Mill Creek & Schuyl. Valley Railroads.

Pottsville, June 11*th*, 1857.

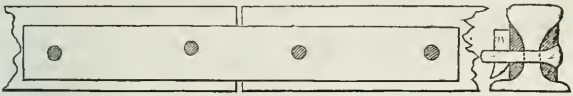
The above 8 examples, and a host of others which we have not room

even to notice, are of the nature of "*supported joints*," in which the chairs carry the ends of adjacent rails, and are themselves sustained upon a single cross-tie.

The following *thirteen* kinds of joint fastening, are all of the nature of "*Fished Joints*," to the use of which in some form all modern experience upon railroads *most strongly tends*.

9. *Wrought Iron Splice*, or "*American Fish Joint*," invented in 1843 by Robert H. Barr, of New Castle, Delaware, put in use upon the New Castle and Frenchtown Railroad, and model deposited in the Franklin Institute, Philadelphia, Nov. 1843. This is the identical "*Fish Joint*," re-invented in 1848 by W. B. Adams, used upon the Eastern Counties Railroad, England, in 1849, and forming at the present moment the most approved railroad joint in England, and we may say in Canada (fig. 7).

Fig. 7.

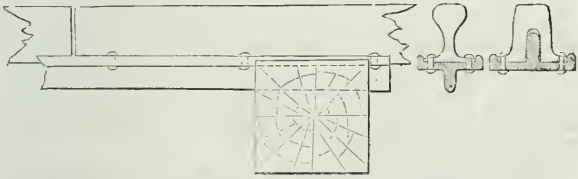


10. *English Fish Plates* of W. B. Adams, (1848.) These are identical with Barr's (1843,) except that Adams' fishes are hollow next the rail, do not fit it tightly, and are secured by screw bolts instead of key-bolts, which last is no improvement.*

11. *Smith's* T *Under-splice of* T *Rail*, patented by Charles E. Smith, of Philadelphia, consists of an under-plate with a rib projecting downwards, and embraced by notches in the cross-ties, while secured by rivets to the rails—this splice is also used with the U rail, (fig. 8.)

12. *Smith's* T *Under-splice of* U *Rail, used upon the Pennsylvania Railroad*, riveted to the base of the rail, and having a rib projecting upwards into the hollow of the U, which completely secures the joint laterally as well as vertically.

Fig. 8.



13. *Under-plate of the Mad River Railroad*, (Ohio.) This is merely a long plate about ⅜ths of an inch thick, with raised edges or lips, between which the rail sets, and the whole being fastened down together to the cross-ties by the ordinary hook-headed spike in notches.

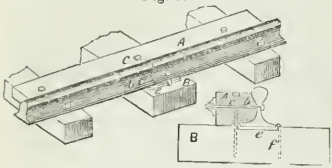
14. *Barr's American Fish Joint, as modified and used upon the Pennsylvania R.R., by Edward Miller, C. E.*, which has proved an excellent joint. The only difference between it and Barr's is, that a small hori-

* Clark's Railway Machinery, page 285.

zontal ledge or shoulder, is rolled upon the rails top and bottom, so as to give a firm seat to the rectangular fish pieces, bolted to the sides.

.15. *Trimble's Wooden Splice*, (fig. 9.) This is applied outside of the rail, fitting its hollow, and extending over three cross-ties, to which it is bolted vertically by long spikes, and secured to the rails horizontally by four screw bolts, while under the joint a piece of iron plate is put. This makes a very good joint, and has received the approbation of some of our best civil engineers. It is sometimes used *double*.

Fig. 9.



16. *Spliced Joint*, from the office of the Pennsylvania Railroad Co. This consists of a combination of Trimble's splice on one side, and Barr's fish plate on the other.

17. *Steele's Combined Joint*, (fig. 10,) now used extensively upon the Reading Railroad, and forming a very good joint. This consists of Trimble's wooden splice outside, Barr's fish plate inside, and the Mad River under-plate underneath rails, and covering the joint, both under-plate and rails being notched for the spikes.

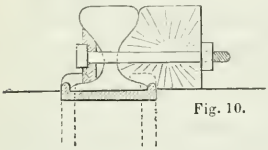


Fig. 10.

18. *Hewson's Long Wrought Iron Chair.* This is an extension of the ordinary American wrought iron chair, so as to carry a joint *between two ties;* it acts in part as a splice, and has the ½-inch parting rod in the centre, separating the rails, which is a distinguishing feature in Col. Hewson's chairs, and enables the rails to be used just as they come from the rolling mill, without boring or notching. This joint is now under trial upon the Upper Schuylkill railroads. Col. Hewson says:—

The original patterns of the long wrought iron chair were ¼-inch thick, 26 inches in length, and 7 inches sill plate, giving on sills 7 inches broad, a space of 12 inches between bearings—50 of these have been laid down and severely tested, and three have been renewed in ten months.

300 chairs 5-16ths inch thick, similar in all other respects to the one described, have been in use for the same period, and also severely tested with no unfavorable results—*none removed.* The pattern sent to the *Franklin Institute*, 5-16ths inches thick, 22 inches long, with 5 inch sill plate, will give a span 8 inches between bearings, which greatly increased their rigidity—500 of these have been laid—have given no indications whatever of yielding—*none removed.*

I have no hesitation in saying that a chair ⅜-inch thick after the size and pattern sent to the Institute, will furnish a redundancy of strength. The Reading Railroad wrought iron chair or under-plate is ⅜-inch thick, 32 inches in length, which upon sills of seven inches, will give a space of 18 inches between bearings.

My chair ⅜-inch thick will have but a space of 8 inches. I think it is better to shorten the chair than to increase its thickness and length, as the track is kept up better.

Placing the joint sills a few inches nearer, will not increase the number of sills to the bar.

The wrought iron chair sent to the Institute will *average* 16 2-10 lbs., 5-16 thick. I have paid 5 cents per pound taking a small quantity; they objected at the mills to furnishing it for less, as they were obliged to alter their rolls.

The cost in unloading, marking off the holes, turning, punching, and fuel, stood at 8 cents each.

This will make the cost per chair, 5-16 thick, as follows:—

16 2-10th lbs. at 5 cents, . . .	81 cts.
Labor and fuel in turning, ...	8 "
Total,	89 "
The short cast iron chair for 60 lbs. rail, weighs 33½ lbs. at 2¾ cents,	92 "
Difference in favor of long wrought iron chair, .	3 "

The Reading Railroad Company pay $75·00 per ton for their wrought iron underplates, which is at the rate of 3⅜ cents per lb. I can doubtless contract for the plates at $90 per ton, which will include the punching; this is at the rate of 4 cents per lb.

The cost of a ⅝-inch chair will then be as follows:—

18½ lbs. at 4 cents, ...	74 cts.
Labor and turning, including fuel, ...	4 "
Total, . . .	78 "

This is 14 cents less than the cast iron chair.

Note.—That the iron should be cross piled at the mill, for it will break when bent with the grain. Different qualities of iron will also require different degrees of heat in turning.

For a simple heating oven without a blast, I prefer a medium between the red and cold short.

The plates when punched are turned at a proper heat by a hand press. The cost for constructing will not exceed one hundred dollars.

I have observed that the end of the rail against the trade receives the hardest usage; thus on the down track of our roads, the northern ends of the bars are more battered, while on the up track the southern ends show the same symptoms. In laying track to strengthen the joints upon a continuous bearing chair, I place the broadest sill against the line of trade, or on that side towards which the heaviest traffic moves.

Pottsville, June 13, 1857. F. Hewson, *Civil Engineer.*

19. *American Fish Plates modified by Ellwood Morris, C. E.* In this joint greater strength is sought to be given to the fish plates, by turning them under the base of the rail. The *fish plates* are to be secured by four key-bolts, and bedded or let down about ¾ths of an inch into the cross-ties, so as to keep them in their proper position even if the bolts fail. The whole to be secured to the cross-ties by the usual hook spikes. This splice is under consideration by a Committee of the Institute, whose report will be made public in due course.*

20. *Compound Rails* of all forms act as fish plates, and make excellent joints, and those with *a solid head*, as used upon the New York Central Railroad, answer a very good purpose in every way.

21. *The Ring Joint of the Camden and Amboy Railroad* (fig. 11).—This

* A difficulty arises in practice from the original form of the fish joint, (fig. 7,) in consequence of the fish plates on the sides of the rails, resting both at top and bottom upon inclined planes, which under the leverage produced by the rolling action of the wheels, become powerful wedges to *break* or to *unhead* the bolts. Late information from England (Colburn and Sanborn, May, 1857,) describes this difficulty of loosening and breakage of bolts as being so serious as to be likely to cause the entire abandonment of "*fish jointing*" in its original form, and it has been already proposed (W. B. Adams,) to stamp the ends of the rails while hot, into square shouldered seats or recesses, for the fish plates.

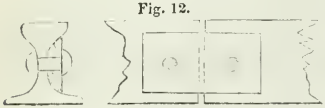
This great practical difficulty is entirely obviated by the square shoulders devised by Edward Miller, C. E., to receive the fishes, or by lapping or turning the fish plates *under the base of the rail*, and notching them into the cross-ties, as proposed by Ellwood Morris, C. E.

singular splice is formed by means of a ring of wrought iron inserted in notches in the ends of two adjacent rails, which are confined in the ring by 3 wedges, one of wrought iron under the bottom, and two cast iron ones on the sides. As originally modeled, the ring was a complete circle, and the under wedge a block of wood (see dotted lines fig. 11). The joint is *suspended* by the ring *between* two cross-ties, and the rails are simply spiked down to the cross-ties in the usual way. This curious but efficient joint contains *a minimum quantity of metal*, and in practice appears to stand very well with the heavy rail and large business of the C. & A. R.R.

Fig. 11.

About twenty years ago, a large portion of the track of the Camden and Amboy Railroad was laid with a 40 lb. rail, with "*link plates*," covering the joints on the *outside only*, as shown in the sketch, (see fig. 12.)

Fig. 12.



These "*link plates*" were about 5 inches $\times$ $2\frac{1}{2}\times\frac{5}{8}$, secured by two $\frac{3}{4}$-inch bolts—they formed in no sense what are called "*fish plates*," (though in a recent discussion in England they have been so called,) since they added nothing to the strength of the joints, and were merely employed as "*a link*" to keep the rails in place lengthwise.

They have not been used in relaying that railroad, but have been supplanted by the "*ring joint*," and others.

General Remarks.

We may perhaps generalize, so as to arrange all railroad joints into two classes.

1st. *Supported Joints.*

2d. *Fished Joints.*

The first are usually formed by chairs or plates, and rest upon a single cross-tie, by which they are "*supported*;" such joints add no strength to the ends of the rails.

The second are now formed either by "*fish pieces*," or "*long chairs*," which are all designed not only to give smoothness and firmness to the joints, but to add also to the strength of the rails at their point of severance. In the present state of our information, there is no question that the best railroad joint is a "*fished joint*," but in what particular manner it should be *fished* so as to combine in a due degree strength, durability, and economy, *is yet an open question.*

In addition to having a good joint, its relative place in the track is also of importance, and on this point there is much difference amongst engineers.

Some insist that both joints in opposite lines of rails should rest on the same cross-tie, or be "*opposite joints*," notwithstanding this duplicates the weakness of foundation; while others insist that the joints in all cases should be "*broken*," or placed opposite the middles of the bars of the other line.

I have no doubt that "*breaking joints*" forms the proper system—and was once compelled to alter a half mile of track from "*opposite joints*"

to "*broken joints*," in consequence of the trouble of keeping it in repair, while the opposing joints rested upon the same cross-tie, which difficulty vanished as soon as the joints were "*broken*" or alternated, so as to bring only one joint on one cross-tie.

"*Broken joints*" have been, *and still are very successfully*, used upon *three* of our leading railroads—the Baltimore and Ohio—the Pennsylvania—and the Reading—while the Erie R.R., which was originally laid with "*opposite joints*," is now being gradually changed, much to the advantage of the road, the comfort of the passengers, and the benefit of the rolling stock.

To show the importance of this question of joints, I may state on the authority of Col. Franklin Hewson, Engineer of the Upper Schuylkill railroads, that the heavy cast iron chairs used upon the Reading Railroad, have all disappeared under 8 millions of tons of traffic; while the cast iron chairs of the pattern shown you (weighing 33½ lbs. each), indicate that they will be destroyed by the transit of little over 6 millions of tons of trade, upon the Upper Schuylkill railroads.

In concluding this subject, I must remark that the expansion and contraction which *theoretically* amounts to one-fifth of an inch (in our climate,) in a 20 feet bar, seems to have been successfully ignored *in practice*, by Norris's chair cast upon the joints in place—by Barlow's saddle rail, which is firmly riveted to under-plates at the joints—by Col. Hewson's parting rod—and by all the forms of compound rails.

While we must admit that change of length in wrought iron must always follow change of temperature, we cannot deny that practically it has far less importance than has usually been ascribed to it, and that the refined instructions given upon this point to track-layers, by many engineers, are of very little moment. *Some* provision must of course be made for change of length by change of temperature; but practice teaches that this provision may be less in extent than has generally been deemed necessary.

Mr. Teas, of Wilmington, Delaware, who is practically engaged in laying down Trimble's Wooden Splice, patented March 10, 1855, (fig. 9,) described this joint at length, and stated that before offering it to other roads, it had been most effectually tested during *six years* upon the Philadelphia, Wilmington, and Baltimore R.R., and that it was now in successful use upon the Baltimore and Ohio, Northern Central, and other important railroads.

He stated that this splice cost 80 cents per joint, and that the patent fee was $10 to $20 per mile. White oak is the timber preferred for the fish piece.

J. Dutton Steele, C. E., described at length the combined joint devised by him, and used at present *exclusively* upon the Reading Railroad, with very satisfactory results.

He laid much stress upon the importance of suspending the joints *between the cross-ties*, and expressed the belief that the Reading R.R. Co. were the first to adopt this great improvement on a large scale.

He expressed the opinion that while the strain upon the rails from the rolling load, was halved by making joints *between ties*, two ties were brought into play as supports instead of one; thus doubling the tie

resistance, and making the joint *four times as strong* as if carried in a chair upon a single tie.

He illustrated this at length, in some able practical observations upon the manner of producing fractures of rails in work.

He called attention to the simplicity of his combined joint, and the ease with which it could be put together, or removed from the track, piece by piece—a point of great importance in the maintenance of railroads of heavy trade.

He thought that the introduction of wood into the joints was important, as giving elasticity, and that the mode of connecting the three parts was of consequence, since the irregularities of dimension in rails made it indispensable that the fastenings should admit of being drawn up, so as to accommodate irregular dimensions, and at the same time grip the rail with sufficient strength. *This splice costs one dollar per joint* (fig. 10).

He had laid upon the Reading R.R., one mile of track with Trimble's splice, and another mile with Reeves & Co's. long chairs, and said that in two years' use the rails of the former were decidedly more worn than those of the latter, laid with long chairs and joints *between ties.*

He explained the mechanism of the action of trains on the rails, saying that the rail upon which the train stood or moved was firmly held by its weight, like a fixed beam, while the forward rail, towards which it was advancing, remained loose, and received a violent shock when reached. He had noticed that on double track railroads, breakage of rails usually occurred forward of the motion of the train, or up track one way, down track the other, and this breakage was usually a foot or two from the joint.

He stated that it was absolutely necessary to provide for expansion, and that he had been compelled to take up and alter tracks too tightly laid. In one instance the track sprung up vertically *one foot*, and shot out sidewise *two feet.*

He never laid any tracks with opposite joints *two on the same tie;* thinks that plan is vicious, and in fact impracticable, except on straight lines, and that it has few if any advocates at the present day.

He stated that owing to some change taking place in the state of integration of the iron rails in use, double-headed rails worn out on top and then turned, lasted but a brief period.

He had also noticed that rails worn in curves, when turned, went to pieces under the traffic with astonishing rapidity, and stated that merely removing and relaying again *the same rails in the same position,* caused them to wear out with much increased rapidity.

He expressed the opinion that an allowance in some form was necessary for expansion, of $\frac{1}{8}$th to $\frac{3}{8}$ths of an inch in rail bars 24 feet long.

Mr. Steele, drawing from the resources of his great experience, illustrated these and other points relating to railway joints, in a very forcible and satisfactory manner.

Frederick Graff, C. E., (just returned from Europe,) was called on by the President, and stated that in England, and upon the Continent, the "*Fished Joint*" was the favorite joint, and Locke's double-headed rail the favorite rail.

That the joints were usually laid upon the same cross-tie—though the newer lines were introducing the alternate system.

The Swiss seem to have paid little regard to the English or Continental examples, but both in their roads, and especially in their rolling stock, they have followed the best *American models.*

Solomon W. Roberts, C. E., stated that there was great difficulty in selecting the best, from amongst the very numerous plans offered for the joints of railways—and he illustrated this by an anecdote relative to the celebrated engineers, Stephenson and Brunel—the former, the great advocate of *detached bearings*, admitting as the result of his experience, that in the end *continuous bearings* were the best; while Brunel, after long practice with *them*, had declared in favor of *the detached system!* For his part, he was now using Reeves & Co's. neatly made wrought iron chairs, and thought them as good as any other joint.

He spoke of the difficulty of securing a fit of iron to iron, and of the disappointment often experienced in results, saying that he had once laid a railroad in apparently the most permanent possible manner, with stone cross-ties upon heavy and well drained ballast, but it did not stand, and he had to resort to wooden cross-ties, really more perishable, but which made a better track than the permanent materials used at first.

He explained the mode of cutting and preparing under his own eye in Wales, the original rails of the Reading Railroad, which have stood very well, and thought it would be a great improvement to modern rails if equal pains were taken with them.

Mr. Roberts expressed his willingness to learn and to adopt well tested contrivances, but did not seem to attach much importance to any of the modern forms of railway joints.

Prof. F. Rogers, C. E., remarked, that although the method of laying the track on the English railroads was familiar to the engineers, it might be interesting to some of the other members to know that on the majority of those roads it differed from the plan adopted in this country.

The rail used is generally double-headed, (Locke's rail,) and is secured to the cross-ties, not by hook-headed spikes, but by a chair at each tie, the rail being wedged into the chair by iron or wooden wedges.

It is extremely difficult to keep these fastenings tight, so that they require continual attention.

On the older railways, the joint chairs are of the same form as the other chairs, but usually rather heavier.

In the later examples in England, fish plates applied on both sides of the vertical web of the rail, are frequently used, the joint being placed sometimes *on a tie*, and sometimes *between two.*

He had seen in Germany in the spring of 1854, a splice made by applying a piece of timber to the outside of the rail on the same principle as Mr. Trimble's splice, which has been described. The two inventions are believed to be entirely independent of each other.

The superiority of the permanent way of the Continental roads over those of our country, and even England, which was undoubted, Prof. R. thought was to be attributed to the great care taken in laying the rails, and to the constant supervision of them, rather than to any peculiar mode of fastening or construction; as with us, this part of the construction which is tedious and disagreeable to the engineer in charge, is often left too much to the mercy of the ordinary workmen.

The smoothness of these roads may be illustrated by the fact that sewing and reading are frequently the amusements of the passengers on the long express routes of Central Europe; and they may either be indulged in without injury to the eye, or inconvenience from the motion.

He thought that the unnecessarily large spaces left between the ends of the rails, were a fruitful cause of destruction to the rails and fastenings.

He also threw out the important suggestion that it might be found advisable to make the rails absolutely continuous in stretches of a hundred yards, or thereabouts, so as to reduce the number of joints in a single track railway to about 35 per mile; and with this small number of joints, he thought we could afford to expend enough upon each, to make them compensate effectually for temperature, and also have an adequate strength to carry the wheels smoothly over, and to resist all lateral displacement, so as to make these comparatively few joints *in fact practically perfect.*

W. Parker Foulke, Esq., concluded the debate, by remarking upon the importance of these practical discussions to the public, and thought that in favor of all well tried devices forming parts of railway structures, and intended to promote the public safety and convenience, all the influence of the Institute should be exerted.

On motion of Charles E. Smith, the meeting adjourned for one week, when the discussion of Railway Joints will be resumed.

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At an adjourned meeting (June 25,) the discussion was continued, Dr. B. H. Rand, Secretary, pro. tem., President Cresson in the Chair.

Charles E. Smith, exhibited a model 16 feet long, showing a section of track laid with miniature U rails, on a 5 feet gauge—to represent the yielding nature of the ground, the rails are laid on cross-ties of india rubber—four joints were made. 1. Without any chair or under-plate, the rails meeting directly on a tie, and being confined by hooked spikes. 2. With a short under-plate upon a tie. 3. With a long under-plate covering three cross-ties, but merely loosely placed. 4. With a long under-plate like No. 3, but firmly riveted to the base of the rails, as in fig. 8. Upon this model track a heavily weighted four-wheeled carriage was placed.

When this carriage was moved along, the action of the joints was beautifully illustrated. No. 1 sunk into the elastic tie, and made a palpably bad joint. No. 2 was better, but still sunk too much. No. 3 yielded less, but yet very perceptibly. While No. 4 did not yield at all, and move the car fast or slow, it appeared to be quite as strong as the rest of the rail.

With this model he had closely studied the question of joints, and he had reached the conclusion, *that, with equal tie spaces, the weakness there was precisely* 50 *per cent. of the strength of the rail.*

He therefore provided an iron splicing or fish bar, with a projecting rib, and attached it underneath the rails, whether U or T, by riveting to the base (see fig. 8). This fish bar covered not less than 3 cross ties; it had just half the sectional area, and half the strength of the ordinary 60

lbs. rail usually employed in this country, and in practice he had found it *entirely successful.* It had been used upon the mountain division of the Pennsylvania Railroad, on the heavy grade under pushing engines of great weight—on a railroad in Georgia—on the Camden and Atlantic Railroad—and on the Mine Hill R.R., (a heavy coal road,) one trial mile had now been down for some years, *and had carried seven millions of tons of coal, without impairing the joints*—this important fact was vouched by the President of the Institute, who is also the chief officer of that road. *This splice costs $2 per joint,* (fig. 8.)

Mr. Smith went on to describe the mechanism of the strains to which railroads are subjected, and considered it self-evident that the sinking of joints and joint ties, was the result of vertical weakness, and could be gotten rid of entirely by augmenting their strength just 50 per cent. by some substantial splice.

He thought there were some objections to Barr's fish plates, and that Trimble's wooden splice would not be entirely satisfactory.

I. R. Trimble, C. E., stated that in 1836, when placed in charge of the Baltimore and Susquehanna Railroad, he had just returned from England. He had found their rail tracks much smoother and better than ours, but no settled system of joints. He early noticed the great defects of our railroad joints, and gave the subject very close attention. He soon perceived that it was idle to attempt an effectual strengthening of the joints, *by any short splice, or by any form of chair whatever, depending upon a single cross-tie.* He saw that three cross-ties at least must be covered, and their united strength of foundation brought in aid of the joint. He made a model and also tried a joint, *suspended between two ties,* now a favorite plan, then first attempted (he believed) by himself.

His first idea was to strengthen the joint by a substantial block of wood, capable of furnishing the requisite strength, and he tried a wooden splice underneath the rails—sinking 3 ties at the joint four inches lower than the rest to admit of it. This worked tolerably well, but owing to the inequality of depth in the foundation, it did not meet his wishes fully.

He was then called to the charge of the Philadelphia, Wilmington, and Baltimore R.R., and found it in very bad condition, especially at the joints; to these he gave his attention, and at first fished them with strong side plates, of wrought iron, which for a time made a very good road, but the bolts would not stand, though he tried both screw-bolts and key-bolts. Finally, he provided a traveling forge, and riveted up hot all the fish plates of the line. Now he supposed all was secured, and for four months it made an excellent track, but then the rivets began to break, and he was eventually forced to abandon the plan of *fish jointing with iron.*

He now recurred to the study of the wooden fish splice, and tried it in a modified form in 1850, using an iron fish plate inside, and the wooden splice outside. Finally, in 1851, he omitted the iron fish plate inside, and used the wooden outside splice alone, in the form patented by him, (see fig. 9.) He found this to furnish all the vertical strength necessary

to make the joint smooth, all the lateral stiffness required, and all the elasticity necessary to preserve the rolling stock.

This splice had now been in use *six years*, it was employed upon many important railroads, and was giving very general satisfaction.

It was fully ascertained by experience, that the wooden splicing pieces outlasted the cross-ties, and that after the first general screwing up, which was found necessary to meet the shrinkage of wood, nothing more was required during the life of the cross-ties upon which the splices rested.

The track-masters whom he had consulted as to the practical working of his splice, assured him, that with it the joint-ties gave them no more trouble than the intermediate ones, and this he considered as adequate proof of the equality of strength given to the track, by the application of his wooden splices.

As engineer of the Baltimore Central Railroad, he had adopted a form for the superstructure of the track, which combined some novelties, (see fig. 13.)

The rail was to be double-headed so as to admit of turning. It was to be perfectly flat on top, and he had planned it with a flat-head of 3 inches wide—but financial considerations caused him to reduce it to $2\frac{3}{4}$ inches flat-head, $4\frac{1}{2}$ high, $\frac{3}{8}$ths stem, and 57 lbs. weight per lineal yard.

Fig. 13.

He thought a good rail should have at least 3 inches flat-head, to stand the momentum of the driving-wheels of the modern locomotive, which if bearing upon an inch wide only (as usual), exert an action superior to the tenacity of iron, and hence our rails fail so rapidly.

He intends to use this double-headed rail without any under-plates, and to abandon in this track the use of the hook-headed spike. He will use a long *outside* wooden splice at each joint (7 feet long, 4×6 inches), and *inside* wood splices ($2\frac{1}{2}$ feet, 3×4 inches,) at each joint clearing the flange, and also over every *alternate* sill space throughout the track. These will be bolted to the ties by straight spikes with square heads, and chisel points of the simplest possible form, and made by machinery.

He thought a joint thus spliced, *inside and out*, by wooden fish pieces neatly wrought to fit the hollow of the rail, would cost about $1·20 each, but that in a mile of track the cost of this improved method of laying railroads would but little exceed that of the usual imperfect plan, with wrought iron chairs.

He thought, in reference to the rapid wear and tear of rails recently noticed, that much is owing to the greater hardness of ballast and firmness of bed in our modern roads.

He remarked upon the Washington railroad, with which he is quite familiar—this line is laid with a very light rail, on a continuous bearing of wood, and the road is very imperfectly ballasted, yet it has stood better than any rail of its weight in the country.

This elastic track, this support of the rail upon a cushion of wood, is what he has endeavored to imitate in his method of splicing.

Mr. Trimble concluded with some interesting general remarks bearing collaterally upon the subject in hand.

Samuel J. Reeves thought in this discussion the momentum of the locomotive was a very material matter, and that the force acting upon the joints of a railway at the tread of the driving wheel, ought to be closely studied by our engineers in connexion with this question.

There could be no doubt that any divided bar could be so spliced—top, sides, or base—as to equal its strength elsewhere, and this could be done in several ways—the question here appeared to be between bolting or riveting on a fish plate, and the sleeve attachment formed by the ordinary chair.

He thought a neatly fitting chair, embracing as with a sleeve the base of the rail, and extending over 3 cross-ties, would be found to fish the joint in an adequate manner.

He was making a neat wrought iron chair (which was shown, and is certainly unexceptionable in its workmanship), weighing 1½ lbs. per inch forward, and which could be furnished, cut off to any length, at 5c. per lb.; at this price a joint chair, 28 inches long, would cost about $2. And this might be regarded as the price of a joint fished with a long sleeve chair on their plan.

Their 10 lb. chair was highly approved by many eminent engineers, and as an evidence of its popularity, he might mention that their orders at this moment were for over 60,000 chairs, of the pattern exhibited.

He made a number of interesting observations relative to the rails of railways, and expressed the opinion that the durability of a rail depended much upon the manner in which its work was imposed.

Thus he thought that if a new rail was worked at first with very light machinery, and then with heavier and heavier, a sort of consolidation of atoms would be produced highly favorable to the life of the rail. Just such had been the actual process to which the original rails of the Reading Railroad had been subjected, and he thought it had much to do with their acknowledged excellent wearing.

In support of this peculiar view, he stated the fact personally known to himself, that the good old rails of the Reading road, when re-rolled and put at once to heavy work, though in heavier masses now than formerly, *showed none of their former superiority over other rails.*

Prof. Fairman Rogers, C. E., thought vertical fishes stronger and better than flat fishes underneath, unless the under-plates were rolled with an attached rib as in Smith's splice, and securely riveted to the base of the rails.

He said that all the joints which had been under discussion, or which he had seen in use here, he had also seen in use in Europe; though he did not pretend at this time to decide upon their priority.

J. Dutton Steele, C. E., stated that in his experience, no form of *continuous bearing* either of wood or iron would answer for the tracks of heavy railroads—for want of elasticity, and this must be borne in mind in every plan for strengthening joints, we must take care not to make them too rigid—if we do, *they will unquestionably fail.*

He instanced the Barlow rail—the large saddle rail—with a base a foot wide to be placed directly upon the ballast. An experimental mile of track with this Barlow rail, was some time since laid upon the down track of the Reading railroad, for trial.

At first this track so laid was very smooth and agreeable, but under the heavy traffic of the Reading railroad, *it did not endure six months*—owing to its extreme rigidity, it was rapidly disintegrated under the wheels, and literally battered to pieces by their heavy locomotives. It became excessively rough and unsafe, *and had to be removed before the expiration of a single year.*

Mr. Steele expressed the opinion, as the result of his large experience, that light rails *per se* were better than heavy ones. And that we should study only to secure in a rail such weight and strength as was necessary to carry the heaviest locomotive without deflexion—that point once gained by a given section, he considered any additional weight added to the rail as being worse than useless.

He said that *the breakage of rails* was much more frequent on all railroads than any one thought of who was not engaged in their supervision and maintenance; some elasticity in the track would often avoid this evil, which was becoming quite a dangerous one, and could not probably be wholly obviated by the manufacturer.

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The general result of this discussion seems to have been that while no one plan of railway joint appears to have commanded the general approbation of the professional members of the Institute, nevertheless *several excellent spliced joints* are now in successful use upon our railroads under a heavy trade. Without pretending to decide the relative merits of these, we will enumerate them in the order of their cost.

1. Trimble's single wooden splice (fig. 9), cost 80 cents each.
2. Steele's combined joint (fig. 10), cost 100 cents.
3. Trimble's double splice (of wood,) (fig. 13), cost 121 cents.
4. Smith's T iron under-splice (fig. 8), cost 200 cents.

All these have approved themselves *to be good* in actual practice, under heavy traffic, except No. 3, which in this precise form has never yet been tried, but it is evidently only a modification of No. 1. Some meritorious joints were before the Institute as being *proposed*, but as they have not yet been tested under heavy trade, we need not particularly name them at this time.

What seems to be wanted in *the joints* of railways, *is the same strength there as the bar has elsewhere*, and that the entire track should rest upon wooden cross-ties, and good ballast, all carefully placed with the view of obtaining *absolute uniformity of strength*, (or of resistance to the rolling load); combined with a uniform elasticity adequate to protect both superstructure and rolling stock from the destructive agency *of impact and vibration.*

After a few desultory remarks from some of the members, the discussion closed, and the meeting adjourned.

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AUGUST, 1857.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Practical Views on the Proposed Improvement of the Ohio River. By W. Milnor Roberts, Civil Engineer.

(Continued from page 38.)

Capabilities of the Tributaries for Large Reservoirs.

It would appear, that excluding for the present, sites on the main rivers Ohio, Monongahela, and Allegheny above Wheeling, the following tributaries drain area of country enough to cover one of the requirements, namely, 600 square miles. *First*, the Big Beaver River, which as it enters below Pittsburgh, is of little or no account in connexion with the present investigation. *Second*, the Youghiougheny river which will furnish a site for a dam 100 feet high; but on account of the great fall in the stream at any point where such a dam would probably be admissible, the pool would not be likely to contain one-fourth of the assumed drainage. *Third*, the upper part of the main Monongahela river; this will probably furnish one good site. *Fourth*, French Creek; on this a dam 100 feet high could be erected, as herein described, but it would not contain more than half of the required quantity. *Fifth*, the Connewango, which may possibly afford a favorable site. *Sixth*, the Kiskiminetas river; although this drains ample territory, there are serious obstacles, as we have shown, in the way of erecting a large dam anywhere on this stream; and nowhere can the erection of a dam of 100 feet height secure the quantity of water assumed. *Seventh* and last, is the Clarion River; and upon this, from the data known, it is almost cer-

tain that a 100 feet dam will not create a pool sufficiently large to contain one-third of the drainage of 600 square miles. Above Pittsburgh, then, independently of the site referred to on the main river Monongahela, in Virginia, there are but five streams that drain 600 square miles; on not one of which is there any reasonable probability that a dam of 100 feet height would form a pool of such size as would contain the drainage of the area named, even estimating at an average of 12 inches, instead of 18 inches, as assumed by Mr. Morris. Either a greater number of dams, or much *higher* structures than the highest yet contemplated must be employed.

The writer is led to infer, that neither Mr. Ellet nor Mr. Morris, in advocating the construction of feeding reservoirs, had taken time to look into the probable practical result of their construction at any *particular points.* Mr. Morris says, "can we find six reservoir sites upon as many creeks, each draining a basin equivalent to 40 miles long by 15 miles wide?"

"Can proper locations be found at the lower ends of these basins for the *six* dams necessary to form six lakes, commanding each a drainage of 600 square miles? Or for a greater number of lakes of equal aggregate capacity."

"For the present, we will assume (what we do not doubt), that *six* suitable sites can be found, and that six dams can be erected, *each* ponding back, or giving an annual available capacity of 25,000 millions of cubic feet of water."

Yet the facts, so far as they can be given approximately without further careful surveys, go to prove that no such sites exist on the creeks. Again, Mr. Morris gives the dimensions of "The Saint Ferrèol Reservoir, built in 1667, the oldest large reservoir is existence, as follows:—(Andreossi's Histoire du Canal du Midi.)

Water raise, . .	= 103 feet.
Height of dam, . .	= 107 "
Length " . .	= 2558 "
Thickness at base, . .	= 394" "

Truly, an immense structure, and which cost an immense sum. Now how much water does that reservoir contain? Does it contain anything like the quantity of water allotted to one of the Ohio River reservoirs? Mr. Morris refers also to the reservoir constructed by William E. Morris, Esq., Civ. Eng., on the western side of the Allegheny Mountains, which has 62 feet water raise, and yet it only contains 466,000,000 cubic feet. It would require 53 *such reservoirs* to fill *one* of the size proposed by Mr. Morris.

With facts like these, it is not difficult to arrive at quite a different conclusion as to the facility of finding on the tributaries referred to, the elements necessary to sustain Mr. Morris in his assumed data. It seems to be tolerably clear, that if dependence is placed upon reservoirs on the tributaries, that a much greater number of reservoirs of much smaller capacity must be adopted.

Leaving the consideration of reservoirs on the tributaries, let us turn our examination to the main rivers, and test the results likely to be attained from dams of 100 feet height thrown across them where they are

navigable—navigable in the ordinary adaptation of the term, for example, below the Virginia State line on the Monongahela, and below Olean on the Allegheny. We will take the Allegheny river immediately above Franklin; of course there is no question here, respecting the sufficiency of the drainage; and a reservoir would be different from the proposed reservoirs upon which Mr. Morris bases his calculations in this; that draining a much larger area of country than would be sufficient to fill it, it might, to a *certain extent*, be employed as suggested by Mr. Ellet, as a regulating reservoir.

Above Franklin, the river has a fall of about 3¼ feet per mile. A dam 100 feet high would back the water about 30 miles. The principal streams flowing in on this distance, are Oil Creek, about 7 to 8 miles up, and Tionesta, about 25 miles up. The pool would be about 75 feet deep at the mouth of Oil Creek, and 17 feet at the mouth of Tionesta. It might back up Oil Creek about 15 miles to Titusville; and up the Tionesta not over two or three miles. It will also flow up a number of smaller tributaries, but not generally very far, on account of their rapid fall. We will take liberal dimensions representing the sloping or descending river valley that the pool is to cover, and assume that it shall average

500 feet	wide,	50 feet	deep,	River.
500	"	30	"	Bottom land.
90	"	15	"	Slopes.
150	"	25	"	"

on the whole distance of 30 miles. This would give in round numbers for the main valley 7,043,840,000 cubic feet; allowing on Oil Creek valley half the average area given on the main stream with half the length, it would give quarter, or 1,760,960,000 cubic feet; the flow up Tionesta would be in round numbers, say 50,000,000 cubic feet. Above the Tionesta the flow in the tributaries would be comparatively trifling, and between Oil Creek and Tionesta, the streams are short and the backwater would not extend very far, but, allowing even one-third as much as in the main valley, it would give 2,337,980,000 cubic feet. The sum would be 11,202,780,000, or considerably less than half of the quantity assumed for one of the large reservoirs proposed, say in round numbers just half.

A second dam thrown across the main river at the upper end of the pool, would, if raised 100 feet, flow to within about 10 miles of Warren.

The *two* might possibly contain 25,000,000,000, the quantity required for one of the proposed large reservoirs. Immediately above Warren, a third dam of 100 feet height might be placed; and as the fall in the river is there about 4⅓ feet per mile, it would flow back about 23 miles to the vicinity of Indian Village, and would contain not exceeding three-fourths of the quantity due to the lower dam.

A fourth 100 feet dam, located at the upper end of the third pool would reach to within a few miles of Olean, and might contain about the same as the third. The capacity of the four would be equivalent in round numbers to 43,750,000,000 cubic feet, or about one and two-thirds of a single large reservoir of 25,000,000,000 described by Mr. Morris.

The entire drainage above Franklin, is in round numbers 4000 square miles, and allowing 12 inches per annum as the available surface drain-

age, the total quantity would be 111,513,600,000 cubic feet, or a little more than three and a half times the capacity of these four great reservoirs. This shows most strikingly the immense bulk of water to be dealt with. Here are four enormous reservoirs, covering one hundred and six miles in length of the main Allegheny River, which will probably contain less than enough to fill *two* such reservoirs as are used in Mr. Morris's calculations.

If the 100 feet dams were placed in the Allegheny River below Franklin, they would create more extensive pools, at the same time the damage to property would be greater. Still one above Brady's Bend, which would back up the Clarion River some miles, would probably contain considerably more than either of those suggested higher up the Allegheny.

Let us now turn to the main Monongahela below the Virginia State line. It will perhaps be admitted, that it is not feasible to build a dam of 100 feet high at any point below Brownsville, for the reason that from the present low water surface at Brownsville to the Ohio River at Pittsburgh, the *total fall* is only 36 feet. If erected just above Pittsburgh, it would therefore raise the water 64 feet at Brownsville, and 82 feet at the mouth of the Youghiougheny. It would destroy so many and such large interests, that we think it may fairly be considered to be out of the question.

The fall between the Virginia State line and Brownsville, 35 miles, is 42 feet. A dam 100 feet high at Brownsville, would therefore flow back about 25 miles into Virginia, and make a depth of 58 feet over the river bed at the State line. Assuming that in the whole distance of about 67 miles, the pools along the main valley should average 800 feet with a depth of 40 feet, and that as much more (which is deemed liberal,) would flow back along the tributaries, the entire pool would contain 23,654,400,000 cubic feet, or say, in round numbers, enough to fill *one* of the proposed large reservoirs.

The writer believes that with the four dams on the Allegheny, and this one as described on the Monongahela, properly managed, a constant flow of not less than 5 to 6 feet could be maintained in the Ohio River at Pittsburgh and at Wheeling; and further may add, that ever since he first roughly tested Mr. Ellet's theory, his opinion has been, that if the river is ever to be maintained at a comparatively steady stage of navigation—that is, constantly above some given number of feet in the channel, without dams on the main Ohio, it would be by means of a *few dams* on the main rivers, in preference to many reservoirs near the heads of the streams, so far as *first cost in building dams* would be concerned. But he has always apprehended that great practical difficulties would attend the carrying out of the plan in either case—that is, either with the few great dams on the main rivers, or the numerous small reservoirs higher up. The present approximate investigation, as it may be called, tends to confirm this opinion.

It may be remarked in this place, that the theory that these large dams may be made to constitute a part of a regular slackwater navigation, as suggested by Mr. Ellet, is certainly fallacious. They may be made to form a part of a descending navigation. On a little reflection it must strike every one, that so soon as a few feet should be drawn down from

the surface of one of these dams, it would leave the upper end of the pool bare, except so far as *a flow* of water might be kept up by water drawn from the dam above. It would create a slackwater of a peculiar character, and require a peculiar and novel arrangement for locking rafts, arks, &c. from a pool which at different periods of the season, would present a variation of nearly one hundred feet in its height of surface. Such arrangement, whatever it may be, would, without question, be regarded as inadmissible on the main Ohio, or on any part of the Allegheny or Monongahela rivers, maintained, or desired to be maintained, as a respectable slackwater for ascending and descending trade.

Mr. Morris, in the Appendix to his paper before alluded to, referring to high dams and the anticipated difficulty of accommodating the lumber trade, &c., remarks "once collected within the pools of the reservoirs, both logs and lumber would be floated from them *through the reservoir dams*, at periodic seasons by means of substantial contrivances, which any skilful engineer charged with these works will know how to plan, construct, and operate with entire success." We know not what particular arrangement may have been in view; but if any plan could be devised satisfactory to those interested in the descending navigation of the Allegheny and Monongahela, which would dispense with the *lockage* at the high dams, it would greatly strengthen the *reservoir plan*.

Mr. Morris has given an estimate of the cost of one of the proposed large reservoirs, which does not however include anything for locks. His estimated cost "for one dam is $2,000,000. Total for the six artificial lakes, say 12,000,000 dollars." This may be quite enough for the number and kind of dams assumed, but is it enough to secure the quantity of water estimated to be stored? The estimate is based on the general idea entertained by him that those large reservoirs could be established on the *creeks* towards the heads of the streams, the damages being estimated at only $10 per acre; whereas, it is obvious that such high dams cannot be profitably located there on account of the rapid fall encountered. And Mr. Ellet says in his paper published in 1849, in the Appendix, "There is no difficulty on any of the principal tributaries of the Upper Ohio, in obtaining reservoirs capable of holding from twelve to twenty thousand millions of cubic feet. It can scarcely be doubted that *twelve* or *fifteen* sites for dams may be selected capacious enough to hold all the excess of water, and equalize the annual discharge so nearly that the depth may be kept within a very few feet of an invariable height." The writer apprehends that surveys will establish a very different result.

But waiving for a moment the consideration of the cost of storing up water by means of high dams or great reservoirs, if we take the Conemaugh reservoir before mentioned, as a criterion of the cost of procuring water, we have 466,000,000 cubic feet, costing $166,000. The quantity estimated by Mr. Morris being 150,000,000,000 cubic feet, at the same rate per cubic foot it would be $53,410,000, and it would require 321 reservoirs of similar size.

But in the case of the few large dams on the main rivers, the cost, including locks for the 100 feet lift at each dam, would probably be much less. The actual first cost is, however, not the only important question. Some adequate and satisfactory arrangement for the passage of the im-

mense descending lumber trade must be provided. Can it be accomplished with dams of 100 feet height, either by means of locks, or in any other manner, in such a practical shape as to be satisfactory to the parties interested? If not, then this objection will be fatal to the plan of placing these immense structures on the main river Allegheny.

In the absence of any definite suggestion respecting the *mode* of overcoming this great practical difficulty, the advocates for artificial reservoirs may be obliged to fall back upon the original proposition of Mr. Ellet—numerous smaller reservoirs towards the sources of the tributaries. Then if we take but one *half* the cost per cubic foot of water, as just calculated, it would amount to $26,705,000.

Is it reasonable to presume that the quantity designated, 150 thousand millions of cubic feet would cost much less?

There can be no doubt that there are several advantages appertaining to large reservoirs on the main streams, where the retained water is to be used for navigation purposes, in commanding surplus water at a lower cost per cubic foot, and in the saving of evaporation. The loss by evaporation from the greater surface of numerous small reservoirs, and on many miles during its flow from those distant points to Pittsburgh would be very considerable, and should not be overlooked in any future critical examination. They could also be more cheaply managed than numerous smaller ones.

Three hundred and twenty-one reservoirs, each as large as that on the Conemaugh, allowing an available drainage of 12 inches depth, would require for each, an area of territory of 16·7 square miles, and an aggregate of 5360 square miles. This would bring into requisition "sites in or near the elevated country," but it will be impossible to avoid encountering in nearly every instance, much more rapid fall than "four feet per mile," and a much less average width of valley than "three-fourths of a mile;" and no where will the depth of a reservoir average half the greatest depth at the dam. Nearly all the head waters within five, and most of them within ten miles of their sources fall 30, 40, or 50 feet, or even more per mile.

It is proposed to examine next, the effect of great reservoirs on the main tributaries or rivers, in connexion with high floods, &c.

Great Reservoirs; their Control of Great Floods.

We proceed to examine the effect of reservoirs on the Allegheny River, &c., in connexion with the great freshets of the Ohio River.

Mr. Ellet has suggested, and to a certain extent elaborated the idea, that it is entirely practicable at an allowable and reasonable cost, to construct large reservoirs on the main branches of the Ohio, or on the Allegheny and Monongahela rivers, which shall give us complete practical control of heavy freshets. He says, "It is not asserting more than the measurements presented in this paper will justify, when it is maintained that it is entirely in the power of man to control all the waters of the Mississippi and Missouri, and compel every river to flow with an even current, from its source in the Allegheny or Rocky Mountains, to its home in the ocean, forever free from the hurtful effects of floods and draughts."

"Reservoirs may eventually be made of sufficient capacity to hold all the annual excess, and make the daily flow almost entirely uniform."

"All this may be accomplished on the Ohio *for about the cost of three or four ships of the line.*" "The great and only difficulty is to overcome the cold incredulity of the public, so as to induce those in power to grant a sufficient appropriation for the completion of the first two reservoirs." The italics are in Mr. Ellet's original paper. Again, "to exercise complete control over all injurious floods, will involve a greater outlay than will be required for the effectual improvement of the navigation; but even this can be accomplished by works which will also secure to the navigation a permanent depth of *six feet, for about the cost of maintaining a ship of the line on a three years' cruise.*"

Mr. Ellet's deductions satisfied his judgment, that the records, measurements, and calculations justified these premises. Mr. Haupt, possibly, without a very critical investigation, seems to sanction to a considerable extent the same attractive idea; and Mr. Morris urges that "six artificial lakes of the size herein contemplated, could not fail to exert a *material influence* in moderating the Ohio River floods." And he introduces the name of Professor E. D. Mansfield, the accomplished Editor of the *Railroad Record*, as greatly strengthening the claims of Mr. Ellet's views to public consideration.

In order to test the question of controlling floods, we propose to go beyond the suggestions of the originator of the proposition in regard to the number of large dams to be employed; and to place the first dam at Wheeling, on the main Ohio River,* and assume that a set of dams, one backing the water to the next above, each 50 feet high are built. If we take 16 dams overcoming a total rise in the Ohio and Allegheny rivers of 800 feet, they will extend 333 miles, or to within five miles of Olean in the State of New York.

The average length of each pool will be 20¾ miles. To be liberal, we assume the average depth above the river, the bottom lands, and side slope of the hills overflowed, at 40 per cent. of the full depth at the dam, or 20 feet; and the average width of the prism of water, at 2200 feet; and add one-third to the total quantity for the flowage or backwater up the tributary side streams. The entire cubical contents of these 16 great reservoirs would thus be 103,150,080,000 cubic feet.

If we allow 12 inches out of an annual fall of 36 inches of water to be available, this would equal about *one-eighth* of all the drainage of 25,000 square miles, which is in round numbers, the area of the territory drained above Wheeling.

Such a flood as that of 1832, which raised the river at Wheeling to 44 feet, would, if continued, fill all these great reservoirs, if *empty at the start*, in three days.

A fall of *two inches* of rain on a frozen surface, would also be sufficient to fill them.

The discharging capacity of the reservoirs, designed to keep up a perennial flow in the Ohio of not less than six feet depth, according to Mr. Ellet's data is 1,164,000,000 cubic feet per day.

* We are not now considering questions of damages, but simply the effect of large dams and reservoirs on floods.

This is an immense body of water, equivalent to the entire contents of 2½ such reservoirs as that on the Western Division of the Pennsylvania Canal, which holds 466,000,000 cubic feet. That is, two and a half such reservoirs must be emptied daily, to create such flow of 6 feet.

It is obvious that these 16 reservoirs, being once filled, even with the discharging pipes purposely left open, will only begin to draw down the surfaces of the pools, when the regular natural drainage into them from the daily flow shall become less than 1,164,000,000 cubic feet; and that then the daily decrease of water held in reserve, will be only the *difference* between such natural flow and the daily discharge.

The inflow never entirely ceases; but, excluding the inflow, these 16 pools would hold enough for 88 days of six feet navigation. Adding thereto the *minimum* daily flow at Wheeling, as given by Mr. Ellet, or 207,360,000 cubic feet, it would make 16 days more, making a total of 104 days. Though it has never occurred, and it is scarcely possible that such minimum flow should continue strictly for one hundred days. Such a state of the water would present a draught far greater than any hitherto experienced in this region.

This goes to prove the capacity of these reservoirs for keeping up a six foot navigation in the river during most seasons. But does it follow, that we shall have attained to the practical command of the great floods? This is the point now to be considered; and we think it may be elucidated by a closer analysis of the important and satisfactory data published by Mr. Ellet. The records, measurements, and tables prepared by Mr. Ellet, are of such a nature that they will perhaps settle this question conclusively. These daily records of the depth of the water at Wheeling begin with 1838, and end with 1848.

Before proceeding to the further examination of these records, we may presume that it will be granted, that in the case of a freshet happening at the moment when the reservoirs should be full, they could afford no aid in controlling floods below the lower dam, assumed to be at Wheeling; or at least no material aid.

We have examined these records to ascertain what the effect would have been had the above system of sixteen dams been in operation from 1838 to 1848 inclusive.

In 1838, the floods would have overflowed all the reservoirs in March, and on every day in April the inflow was greater than the discharging capacity; and for 22 out of the 30 days it was considerably more than double. In May and June, there was no day when the inflow was not greater than the discharging capacity. In May, the freshet rose on different days, to 24, 31, 29, and 26 feet respectively; and as that flood would have found overflowing reservoirs, no portion of it could have been controlled There was not a single day for over three consecutive months, when the reservoirs would have aided in restraining large freshets. Then followed the memorable 120 days of extremely low-water, during which period the natural flow at Wheeling, according to Mr. Ellet's tables, was 26,400,000,000, which, added to the aggregate content of all the reservoirs, would have made a total of 129,500,000,000 cubic feet. The quantity required for a continuous six feet stage through the same period, would have been

139,680,000,000 which would have left a deficiency of 10,188,000,000. There would have been a little deficiency before the commencement of the 120 days. One or two large dams on the Monongahela in addition, would have supplied the entire deficiency. It is evident, on inspection, that the 16 dams would have been sufficient to have maintained over five feet depth all the time.

In 1839, seventeen days in January and eleven days in February were not recorded. We cannot therefore decide with certainty that the reservoirs would have been filled then. They would certainly have filled in March, if not before; and they could not have been materially drawn down until the first week in July. In March, April, May, and June, they could not have assisted in restraining heavy floods had any occurred. As it appears, the highest freshet was on June 16th, 23 feet. But during this period of nearly four months, the river was constantly liable to receive a first class flood.

In 1840, the record begins with January 22d. We have no present means of knowing what proportion would have been in the reservoirs on that day, and will not surmise. From that date until the end of the month, the inflow was very much more than the discharge would have been. By the middle of February, the reservoirs would certainly have been full. The first heavy flood of that month, which rose to 38 feet, might have been slightly held back, unless the flow before January 22d was heavy. But in any case, the reservoirs would have been *nearly full* before the commencement of this heavy flood; whilst the second great flood of the same month, on the 25th and 26th, which rose to 36 feet, must have found the reservoirs *largely overflowing*. Even if the reservoirs had been absolutely empty as late as the first day of February, which we know could not have been the case, they would have been filled before the 18th, before the beginning of the second flood. The flood of May 1st to 5th, which rose to 28 feet, would also have come upon overflowing reservoirs.

It is singular, that this marked exemplification of the inutility of such reservoirs as a means of controlling floods, should have escaped the observation of Mr. Ellet.

In 1841, the record begins on January 10th, when the depth at Wheeling was 22 feet. The average depth for the remaining 21 days of that month, was 14 feet, which would have half filled the reservoirs had they been empty January 9th, which, of course, could not have been the case with the water at a flood of 22 feet on the 10th. There might, or might not have been a chance of restraining, to some extent, a flood in February. In March, when the freshet of the 23d to the 31st came, the reservoirs would have been drawn down a mere trifle, and this flood which rose to 34 feet on the 29th might have been very slightly checked. From that time until the latter part of May, the reservoirs would have continued to overflow. In December, they would have been again overflowing. But during all the months of February, March, and April, or most of the time, they could not have aided in restraining floods. The highest water in April was 28 feet, and in May 20 feet.

In 1842, the reservoirs would have been overflowing in the beginning

of the year, and would have so continued until about June; offering during those five months, no protection whatever against the effects of floods below Wheeling. And *there were* freshets: in January, 22 feet; in February, two of 28 feet each; in March, 26 feet; in April, two of 18 feet each; and in May, 19 feet.

In 1843, from January 1st to 31st, there was enough inflow to fill the reservoirs; and as they would have been at least half full at the close of 1842, they would have overflowed by the first of February, and from that time until the latter end of June, nearly five months, they would not have ceased to overflow; and during all that period could have rendered no service in arresting great freshets or any freshets. The inflow during the month of April was remarkable; showing an average depth of 19·4 feet for the whole month; sufficient to have more than twice filled the reservoirs; *the whole of which* would have passed along on the top of overflowing pools. In December, the reservoirs would have been again overflowing. The highest waters were in March, 18 feet; April, 20 and 27 feet; May, 18 feet; June, 19 feet.

In 1844, throughout January, the reservoirs would have continued to overflow. In February there would have been a slight draught upon them taking about 1½ feet from the surface. In March, they would have overflowed; and they would have continued overflowing until August, when they would have been partially drawn down to keep up the required flow for August, September, and October. In November and December, they would have again filled. Thus in April, May, and June, the reservoirs could have been of no avail in restraining floods. It happened that there was no large flood in 1844.

In 1845, commencing with full reservoirs, they would have continued to overflow until near the middle of April, affording during this period of three months, no assistance in holding back freshets. The highest flood occurred March 12th, when it rose to 24 feet. This was a remarkable year along the Ohio Valley; for although it presents much the smallest total yearly flow, so that it would have made a uniform depth throughout the year of but 7·03 feet, yet it happened to be so equally distributed, that the reservoirs we are now considering, would not at any time have been emptied. The lowest average depth at Wheeling for a month, was 2·82 feet, in August; the next lowest was 3·4 feet in September. The floods were moderate, rising to 21 feet in January, and 24 feet in March; both of which would have come upon overflowing reservoirs. In December, the reservoirs would have been about half full.

In 1846, the reservoirs would have filled in January, and remained full until June, when they might have been slightly drawn upon, (though the average flow for the month of June was fully up to the quantity required for a 6 feet stage of water.) In July, they would have been overflowing. In November and December, they would have been largely overflowing. In December, alone, more than *four times* the discharging capacity would have drained into the reservoirs. On the 15th of March of this year, there was a heavy flood, which rose to 35 feet at Wheeling; but the reservoirs must have been overflowing when it came. In December, there was a flood of 28 feet, with the reservoirs overflowing before it commenced. At the close of the year, all the reservoirs would have been largely overflowing.

In 1847, a flood of 28 feet occurred, January 30, which would have been on the top of largely overflowing reservoirs; and they would have continued to overflow for four months or more, until the latter part of May, when a *very* slight draught would have been made, leaving them overflowing again in June. In October, they would have filled again. In October, more than *three times* the discharging capacity flowed in; in November, nearly *three times;* and in December, over *six times.* In addition to the January flood, there was one in February of 27 feet; one in March of 27 feet; one in November of 32 feet; one in December of 38½ feet; not one of which could have been retarded or controlled by means of the reservoirs. In the single month of December, the inflow was more than enough to have filled all the reservoirs *twice*, had they been empty on the 30th of November, and yet we see that they must have then been full.

This was another remarkable season. The average depth for the lowest month, September, as recorded at Wheeling, was never less than 4 feet; the actual lowest water being 2¼ feet for three days. The drainage this year, would have filled all the reservoirs more than *ten times* could they have been emptied each time. The highest flood recorded in the eleven years, would have swept over the top of overflowing reservoirs.

In 1848, starting with overflowing reservoirs, they would have continued overflowing until June, with an almost imperceptible draught upon them in June, which would have been supplied again in July. Before the 20th of December, they would again have been filled to overflowing. In January, there was a freshet of 26 feet; in March, one of 18 feet; and on the twenty-fifth of December, another of 26 feet; all of which would have found the reservoirs full, and which, therefore, could not have been restrained. In December, the inflow was equal to *five times* the discharging capacity.

Thus the record for these eleven years proves, that although in a few instances, floods might have been in part checked by the operation of the reservoirs, yet in the great majority, including the *very heaviest* floods, the freshets would have passed along on their ocean bound course entirely uncontrolled. Out of thirty-two floods recorded, there were but *two* or three when the reservoirs would not have been full.

It is a fair query then, whether instead of being advantageous as means of controlling floods, they would not have been positively injurious? According to the theory of those who oppose the lock and dam system, the depth of the river below the lower dam in time of flood, would be *greater* than it would be without the dams, and this would be further increased according to Mr. Morris's suggestion, in consequence of the prism of water, six feet deep, which would constitute the lowest stage of the river. The inference would be, that the freshets below the lower dam, in a large majority of the floods, as recorded, would have been *greater* with the reservoir system in operation, than with the river left in its natural state.

It may be argued, in discussing this branch of the subject, that the venting capacity of the dams could be made greater than barely sufficient to discharge the quantity required for a six feet navigation, the capacity allowed in the foregoing examination. True, but in reply it may be

stated, that in actual practice, the real discharge in different stages of water in the pools, would *require* much more extensive apparatus than would be barely sufficient with full pools; for the reason that when they should be reduced considerably, the pressure at the pipes would be correspondingly reduced, and the discharge proportionally decreased; so that when the pools should be drawn down half the depth, or 25 feet at the dam, double the capacity of discharge would be necessary; and when three-fourths drawn down, four times the capacity, and so on in proportion as the pools should be emptied. The apparatus, with only 10 or 12 feet of pressure, would necessarily be very extensive.

But again, should it be admitted that even very much greater discharging arrangements could be employed, than any hitherto alluded to by the friends of the reservoir system, so as to give control over a larger proportion of the heavy freshets, it must be recollected, that there would be a limit to this also. We cannot overlook the *fact*, that no human foresight can divine when it would be safe to draw down the reservoirs for the purpose of *being prepared to catch a great flood*, in view of the other objects of their construction, namely, *storing up* water to be used in time of need.

Let us glance at this in another aspect; although the quantity of water calculated as stored up in these 16 dams of fifty feet height, flooding over 333 miles of a great river valley, an average depth of 25 feet above the natural surface of the stream, is but two-thirds of the quantity assumed by Mr. Morris in connexion with the six reservoirs designated by him, yet the field of operation is much more advantageous on the main river, than it would be on the smaller tributaries, for securing through the year a given quantity of water; irrespective of damages to property, towns, cities, and navigation interests. These river pools or reservoirs, would be in a much better geographical position for controlling large freshets than the reservoirs on the tributaries; because on the tributaries if they were so located as to command only about a sufficient area of territory to fill them but once during a dry season, it would not be safe to discharge *any portion* of their contents, except for *one* object, namely, to aid in keeping up the flow of the Ohio River to 6 feet depth during the dry portion of the season. If they should be emptied for the purpose of acting as reservoirs to *catch floods*, or to break the force of contemplated or expected floods, the records show that *great risk* would be run of having no water of consequence in the reservoirs when it might be *essential* for sustaining the navigation. The periods of heavy rainfalls are so entirely irregular, that the judgment of man could not regulate and bring into harmony the two things desired, upon any data that we know of or have assumed.

In order to obtain any practical, reliable control of freshets, much more extensive, and much more costly constructions would be absolutely necessary, than all that we have been considering.

It would appear, then, that Mr. Ellet's suggestions, though beautiful and desirable, are not, as he has announced, "*easily and cheaply practicable.*" That on the contrary, in regard to the great freshets on the Ohio River, to control them practically, would require an expenditure vastly greater than he has estimated, and would involve the *destruction* of the

present navigation of the Allegheny River; which is entirely too important to be ignored; and would come into conflict with thousands of citizens, whether in the shape of immense dams on the main rivers, comparatively few in number, or reservoirs on the tributaries, smaller but greatly more numerous. But the writer does not by any means rest the question now under consideration wholly upon this latter suggestion. Nevertheless, it is a practical matter to be practically thought of.

(To be Continued.)

Railway Accidents in 1856.*

By the report of Captain Galton, of the Railway Department of the Board of Trade, of the accidents which occurred on and by the railways of the United Kingdom, during the past year, 1856, we learn the following particulars, which for the convenience of our readers we place in a tabular form :—

ACCIDENTS IN 1856.

	Killed.	Injured.
1st. Passengers, . . .	27	298
2d. Servants of Companies or contractors employed on railways, .	142	80
3d. Persons neither passengers nor servants of Companies, .	112	16
	281	394

Thus, from the three classes named, 281 persons were killed in 1856, and 394 injured.

But let it not be supposed that the railways are chargeable with having done all this mischief, small though it be in relation to the numbers carried and employed in the year. Some committed suicide, many were trespassers, others would cross the railways when they had no business to do so, others fell victims to their own carelessness, &c., &c. The real extent of damage to the public by the railways is comparatively very small. Indeed, on many English lines no accidents whatever have occurred during the past year, and in the language of Capt. Galton—"Upon certain lines no accidents have occurred during the last *six years*." It is also most gratifying to find—"The number of accidents into the causes of which your lordships deemed it desirable to institute inquiries, is also smaller than that for the preceding three years. It may, therefore (continues Captain Galton), be safely assumed that the railways have been worked with a greater degree of care than in former years."

We have said, on the authority of the Government reporter, that 27 passengers were killed in 1856 on the railways of the United Kingdom. But 27 were not killed *by* the railways. Only eight were killed by the railways, that is, "from causes beyond their own (the deceased passen-

* From Herapath's Journal, No. 923.

gers') control." 19 of the 27 were killed "from want of caution on their own part." If a passenger from his own carelessness gets killed on a railway, we cannot blame the railway any more than the canal into which a person tumbles, and thereby loses his life. It follows that the railway Companies are justly blameable for the loss of only eight passengers' lives in the course of last year, and yet in that year about 130 millions of passengers were carried over a length of railway of 8500 miles; that is, but one passenger out of 16¼ millions conveyed, met his death by the railways, a result which Lord Campbell himself must feel thankful for.

An elaborate table is furnished of the accidents since 1850, which we condense into the following statement:—

	Mean No. of miles open.	No. of passengers conveyed.	No. of passengers killed.	Proportion to No. of passengers conveyed.
1850	6326	72,854,422	12	1 in 6,071,202
1851	6755	85,391,095	19	1 in 4,491,268
1852	7113	89,135,729	10	1 in 8,913,572
1853	7488	102,286,660	36	1 in 2,841,296
1854	7812	114,358,888	12	1 in 9,529,907
1855	8175	118,595,134	10	1 in 11,859,513
1856	8499 (say)	130,000,000	8	1 in (say) 16,250,000

The returns of the number of passengers conveyed during the second half-year of 1856 being incomplete, disable Captain Galton from giving the exact proportion in that case, but it is perfectly clear (to us) that the number for the whole of 1856 can hardly fall short of 130 millions. As about 118½ millions were the number carried in 1855, it might be thought 130 millions in 1856 are an excessive calculation. But we can give reasons to show that it is not so. 1854 increased over 1853 by more than 12 millions. And 1853 also increased over 1852 by more than 12 millions. 1855 did not increase over 1854 to the same extent, owing to special and extraordinary causes. We have the return for the first half of 1856, and this shows a larger increase over the first half of 1855, than the first half of 1854 does over the first half of 1853. If the second half of 1856 progressed as did the first half of 1856, there would be between 132 and 133 millions, as the number carried in 1856. Therefore we think we may safely say the number is 130 millions, or about 11½ millions increase over 1855.

Well, eight passengers killed by the railways in 1856, out of 130 millions carried, or 1 in 16¼ millions! Let the fact be well known and strongly impressed on the minds of those fearful of railway traveling. Let it be known that it is no uncommon thing to find that no fatal accident has occurred on a long line of railway in the last six years, notwithstanding that millions of persons have been annually conveyed over it at high speeds. Let it also be borne in mind, that, averaged over the whole length of railways, the infinitesimally small extent of accident that has occurred in the past year is the result of evils that may be cured, of matters of detail in management that may be remedied, and we think any candid person of ordinary capacity must admit, that the railway sys-

tem is in itself as near an approach to perfection as anything in this world can be. If we were all as perfectly sound in our minds, and as perfectly good in our hearts, as the railway system is safe as a means of conveyance, we should be infinitely better than we are—yet the fashion is to speak with horror of the extent of fatal railway accidents, and millions annually are doubtless deterred from enjoying the pleasure of traveling in fear of the *risk* of danger in it!

Captain Galton observes—"It is worthy of remark, that none of the accidents which occurred during 1856 were due to the permanent way being in a really defective condition. The immunity from accident on this ground appears to be attributable to the great attention which has been given by engineers to the subject of permanent way, and *to the introduction of the fished joint*, and of other improved methods of connecting the rails at the joints." Respecting "facing points," it is remarked—"The use of facing points on railways has always been a fertile source of accident, and the additional experience which is daily acquired on the subject shows that the self-acting principle cannot be safely trusted on a main line of railway, but that facing points, when passed by trains at any speed, should always be held, pinned, or locked in position."

Collisions of trains, resulting, of course, from carelessness, are the principal causes of railway accidents—passenger trains running against trucks and goods trains or other passenger trains. But every year sees them diminishing; the system of management improving. "The railways have been worked (in 1856) with a greater degree of care than in former years." In course of time, an accident on an English railway, we trust, will be regarded as a most extraordinary occurrence, and a person will no more apprehend danger while sitting in a railway carriage, and traveling at the rate of 40 miles per hour, than in leisurely walking along the streets of London. Freedom from accident, fatal especially, would not only be a mercy and a boon to the traveling public, but would so greatly enlarge the extent of traveling, that the railway companies would, in a pecuniary point of view, reap an incalculable amount of benefit from it. There is no doubt that fear prevents vast numbers from traveling, although it is so far unfounded, that in the United Kingdom, for every 16¼ millions of persons conveyed, only one loses his life—a fact that completely establishes the extremely exceptional character of fatal accidents on the railways of this country. The orange peel in the streets of London, doubtless, causes more loss and damage to the lives and limbs of Her Majesty's subjects, than all the railways within these her realms, though the extent of their traffic is no less than 130 millions of passengers in a year. The public in point of safety, as well as economy, have gained immeasurably by the introduction of railways in the room of the stage coaches.

AMERICAN PATENTS.

List of American Patents which issued from May 12th, to May 26th, 1857, *(inclusive,) with Exemplifications.*

MAY 12.

65. For an *Improvement in Wrought Iron Plate Railroad Car Wheels;* G. W. Alden, City of New York.

Claim.—" Constructing the tread and flanch of the wheel, and connecting the same with the hub or centre thereof, by the combination of the two plates, and uniting in the flanch of the wheel."

66. For an *Improved Apparatus for Heating and Cooking by Gas;* R. Snowden Andrews, Baltimore, Maryland.

" The invention consists in presenting hot drafts to the burning mixture of gas and air—thereby producing great intensity of heat."

Claim.—" Its tubes, hot air chamber, perforated rim, and spreading flanch."

67. For an *Improvement in Self-indicating Balance;* Z. W. and O. Avery, Bethany, Pa.

" The invention consists in applying a rolling poise to the top of the balance beam, both the poise and the beam being smooth, so as to offer the least possible resistance to the poise as it rolls out on the beam."

Claim.—"The combination of the rolling poise with the smooth beam and armature."

68. For an *Improvement in Signal Lamps;* R. P. Bailey, Niagara, New York.

Claim.—" The means employed to raise and lower the colored tubes by means of the rings and chains, so constructed and attached that one tube or cylinder may play or move up and down within the other, and independent of each other, thereby allowing the different colors to be changed without obstructing each other."

69. For an *Improved Rotary Shingle Cutter;* Wm. Bevard, St. Louis, Missouri.

Claim.—" The combination of the automatic feeding apparatus, with the rotating shingle machine, and also the curved knife when combined."

70. For an *Improved Stitch for Sewing Machines;* C. F. Bosworth, Petersham, Mass.

Claim.—" Forming a stitch by passing a loop of thread through any material to be sewn, and passing a loop of thread taken from the opposite side through it, and fastening the last formed loop by passing the body of the thread upon the same side entirely through the said loop."

71. For an *Improved Portable Barrack;* M. F. Brantingham, Sangamon Co., Illinois.

Claim.—" The combination of separate and detached pieces of material, so as to form a barrack which can be used for the protection of crops from the weather, and which can be readily separated again for removal from place to place, and then re-constructed."

72. For an *Improvement in Corn Planters;* John Broughton, City of New York.

" The invention consists in having a flexible tube, sack, or seed chamber, constructed of muslin or any suitable cloth, or any woven fabric, the lower end of said tube being connected to a distributing device, and the upper end connected to a plunger which passes through the tube or sack, so as to form a light, simple, durable, cheap, and efficient implement."

Claim.—"The distributing device formed of the block having the opening made longitudinally through it to receive the plunger, having the recess made in it; the block being provided with the chamber, slide, and tube, when said distributing device, or its equivalent, is used in combination with the flexible tube or sack."

73. For an *Improved Apparatus for Roasting Meat;* John G. Brown and John P. Derby, South Reading, Massachusetts.

Claim.—" A new article of manufacture, consisting of a pan with the handles, sockets, the movable standards, ratchet wheel, pawl, and spit, for a roasting apparatus."

74. For an *Improvement in Seed Planters;* John H. Bruen, Penn Yan, New York.

Claim.—" The tube, in combination with bar and disk distributor."

75. For an *Improved Mode of Overcoming the Windage in Fire Arms;* Ambrose E. Burnside, Bristol, Rhode Island.

Claim.—"1st, The cap or patch which covers the ball or shell, said cap not being permanently attached to the ball. 2d, The enlarging of the cannon ball or shell, after it reaches the enlarged chamber of a cannon by means of a cap or patch of soft expansive material, such as leather, malleable metal, or the two combined, in order that the ball and cap together may be some larger than the bore, and therefore prevent windage in passing out of the bore."

76. For an *Improvement in Machines for Making Lozenges;* Oliver R. Chase, Boston, and Silas Edwin Chase, Charlestown, Massachusetts.

Claim.—"The combination of the reducing rollers, the directing and gauging rollers, the endless aprons, and the sugar receptacles formed by the endless aprons, the two rollers and the side plates or timbers of the frame, the whole being for the purpose of reducing the dough or mass of paste to an equal thickness, and applying strata of powdered sugar or material to its flat surfaces. Also, the striker and its operative mechanism, as combined with the cylinder, and made to operate in connexion therewith, not meaning to claim a roller as combined with the cylinder for simply forcing the dough into the cutters by pressure—but a contrivance like the striker, which forces the dough into the cutters, and the latter through the dough by a blow or percussion. And in combination with the cylinder of cutters and the striker, a flexible or elastic roller as applied and used, and for the purpose of finishing the surfaces and edges of the lozenges after the action of the striker has taken place. And, in combination with the rotary series of cutters, pistons, and scrap clearers, and their operative mechanism, the two endless aprons, for respectively receiving the waste or scraps, and the lozenges, and conveying them out of the machine."

77. For an *Improved Machine for Cutting Match Splints;* Thomas Cook, City of New York.

Claim.—"The arrangement of the block carrier so as to have the two motions, whereby the splints may be cut by stationary cutters. Also, the method of supporting the block in the box by the longitudinal pressing springs, in connexion with a feed follower acting in conjunction therewith."

78. For *Artificial Honey;* Zenas Corbin and Gideon Marlett, Syracuse, New York.

Claim.—"Artificial honey composed of the enumerated ingredients, or their equivalents, combined with each other."

79. For an *Improvement in Horse Shoes;* David Cumming, Sorrel Horse, Penna.

Claim.—"The false bottom or holding plate, when used in connexion with the movable calks."

80. For an *Improvement in Hook Temples for Looms;* Warren W. Dutcher and Geo. Draper, Milford, Massachusetts.

Claim.—"Combining with the temple and its spring, a lever, or its equivalent, that just before the lay beats up it shall, by its action on such lever, cause the temple to be advanced on the cloth or towards the reed, in order that when the lay may move in the opposite direction, the spring of the temple shall draw back the selvage of the cloth so as to straighten the warp threads thereof."

81. For an *Improved Method of Connecting the Check-piece to the Mouth-piece of Bridle Bits;* Kasson Frazer, Syracuse, New York.

Claim.—"Constructing check-pieces of bridle bits by making a neck at each extremity within the ball of the mouth piece, and securing the same therein by means of filling the chamber around the necks with metal or other composition."

82. For an *Improvement in Corn Huskers;* E. F. French, Franklin, Vermont.

Claim.—"The combination of the endless aprons and rollers, two or more, covered with india-rubber or other elastic material."

83. For an *Improved Mode of Constructing Portable Houses;* Daniel Fitzgerald, City of New York.

Claim.—"1st, Uniting the roof in sections to render it portable. 2d, Cutting down a space in the sill, and tenoning each side so that the door frame will set close down and be held firm."

84. For an *Improvement in Semi-rotative Steam Engines;* C. B. Gallagher, Allegheny City, Pennsylvania.

Claim.—"The arrangement of means for producing continuous rotary motion from the semi-rotative piston of the engine."

85. For an *Improvement in Needles for Sewing;* Benjamin Garvey, City of N. Y.

Claim.—"A sewing needle having a self-closed eye with a slit leading outwardly, and made to terminate at a point more or less remote from the eye, through which slit the thread may be forced into the eye."

86. For an *Improved Nail Plate Feeder;* John C. Gould, Boonton, New Jersey.

Claim.—"1st, The feed rod, the forked spring arm, in combination with the feed-rod. 2d, Placing the ratchet cam on an arm, for allowing it to have a forward and backward motion, also a vibrating motion for the purpose of accommodating itself to the movement of the nose-piece, and for revolving the same."

87. For an *Improvement in Hemp Brakes;* J. Locke Hardeman, Arrow Rock, Mo.

Claim.—"The employment, in combination with a stationary platform composed of bars *q*, of a pair of curvilinear moving platforms composed of bars *c*, *e*."

88. For an *Improvement in Seed Planters;* John Haselton, Orford, New Hampshire.

Claim.—"The arrangement of roller and sliding frame."

89. For an *Improvement in Propeller Blades;* George Hibsch, Buffalo, New York.

Claim.—"Constructing propeller wheels having blades."

90. For an *Improvement in Harvesters;* Moses G. Hubbard, Penn Yan, New York.

Claim.—"The employment of the cogged segment attached to the pole rocker, in combination with the worm, for the purpose of elevating and depressing the frame."

91. For an *Improvement in Presses for Cotton, &c.;* Henry Hughes, Port Gibson, Mississippi.

Claim.—"The employment of a grooved plate, having a horizontal or other formed surface, with grooves thereupon for the purpose of operating the levers."

92. For an *Improved Process for Treating Raw Cotton;* Julius C. Hurd, Medway, Massachusetts.

Claim.—"The treatment of cotton by bleaching previous to picking or carding it, for the purpose of removing the motes and trash."

93. For an *Improvement in Harvesters;* Moses G. Hubbard, Penn Yan, New York.

Claim.—"The combination of the shifting fork, short crank, and handle, for throwing the machine out of, or into gear."

94. For an *Improvement in Folding Bedsteads;* James A. Johnson, Antrim, Ohio.

"The invention consists in constructing a model bedstead, having hinged joints, so arranged that the bedstead can be thrown into several convenient and accommodating positions."

Claim.—"The accommodating brace, with the stay block, and hinged jointed rails and posts, for the purpose of forming an invalid, or other bedstead, as required, easily removed without being taken apart, either whole or in part."

95. For an *Improvement in Bed Bottoms;* J. F. Keeler, Cleveland, Ohio.

Claim.—"The eyelets and the cords, with or without the springs, connected with the rails, and arranged in relation to the slats."

96. For an *Improvement in Coal Stoves;* John C. Keller, Philadelphia, Penna.

"The invention consists in a new method of introducing hot air into the fire chamber of a stove, above the coal by means of tubes."

Claim.—"The arrangement of the perforations in the cylinders, situated opposite to each other, so that the current of air entering shall be divided and heated by passing half around the cylinder, previous to entering the groove through the perforation."

97. For an *Improvement in Blacksmiths' Striker;* Hartwell Kendall, East Dorset, Vermont.

Claim.—"The use of the springs."

98. For an *Improved Mortising Chisel;* George P. Ketcham, Bedford, Indiana.

"This invention relates to an improvement by which the mortise is cut and cleared of chips or blocks at one and the same stroke of the chisel."

Claim.—"The employment of the divider and the shoulders."

99. For an *Improved Joiners' Plane;* Benjamin I. Lane, Newburyport, Mass.

Claim.—"The sliding plate, with bar attached, through which the screw-rod passes, the plate being operated by the wedge and screw-rod. Also, in combination with the plate and bar, arranged and operated as shown, the screw-rod applied to the iron, and connected with the plate and bar, whereby the iron may be adjusted or 'set' with facility, and also secured firmly in its proper position within the plane."

100. For *Improved Cartridges;* Edward Lindner, City of New York.

Claim.—"A cartridge, in which an annular wad and the casing to contain the powder are formed of the material, and secured thereto by the act of casting the ball."

101. For an *Improved Machine for Boring Flue Sheets of Steam Boilers;* Sylvanus V. Lowe, Reading, Pennsylvania.

Claim.—"The attachment and use of mandrel, when constructed, arranged, and adapted to this purpose only."

102. For an *Improvement in Cleaning Guard of Grain Elevators;* George Mann, Jr., Ottawa, Illinois.

Claim.—"The sliding grate or screen, having its lower part curved or bent, and used in connexion with the slide."

103. For an *Improvement in Machines for Engraving Cylinders;* Robert Muckelt and Wm. Rigby, Salford, England.

Claim.—"1st, The levers and the parts therewith, varying the relative proportion between the original design and that produced when applied to machinery for engraving designs on cylindrical or other surfaces. 2d, The ruler or guide plate."

104. For *Improved Blasting Powder;* Antoine Murtineddu, Marseilles, France.

"The invention consists in a new composition of matter, which, when ignited, will not explode, but will give out such a great amount of heat that it will blast rocks with great ease and without danger."

Claim.—"The composition of matter."

105. For an *Improved Joiners' Bench Strip;* Charles T. Pearson, Chelsea, Mass.

Claim.—"Attaching the strip to the slides, which are fitted in dove-tail grooves in the bars, the slides being provided with pawls, against which springs act."

106. For an *Improvement in Locks;* Stuart Perry, Newport, New York.

Claim.—"Operating the key, tumblers, or slides of locks, by such an arrangement of parts within the lock, that every time it is worked said tumblers or slides must, in relation to their furrings or guides, be moved by the key stem, or its equivalent, beyond the limits to which the key-bits move them, and sufficiently beyond and with such differing distances among themselves, beyond that the limits of their full movement shall be entirely different from the limits of their partial movements in the same direction by the key-bits, thus producing false clues, and effectually destroying all true clues for picking in the ways."

107. For an *Improved Coal Cracker;* Townsend Poore, Carbondale, Penna.

"The invention consists in the combined use of the rocking crusher with the grated hopper, part of which hopper is stationary, and part movable, and working in connexion with the crusher."

Claim.—"The combination of the rocking cracker with the fixed and swinging gratings."

108. For an *Improvement in Devulcanizing India-Rubber;* Conrad Poppenhusen and Ludwig Held, Brooklyn, New York; ante-dated April 1, 1857.

Claim.—"The process of rendering vulcanized india-rubber, gutta-percha, or allied gums, or their compounds, soluble and plastic, by the joint action of the solvents and dry ammonia gas."

109. For an *Improved Piano-Forte Bridge;* Thomas E. Power, Columbia, Mo.

Claim.—"The cutting away the end of the bridge upon which the treble strings rest, and the supporting of the same by bars in such manner as to permit a greater vibration in the surface of that part of the sound board which is under the treble strings in the piano-forte, to the end that the notes sounded by those strings may be more full and perfect."

110. For a *Trap for Animals;* Frederick Reuthe, Hartford, Connecticut.

Claim.—"The sliding and expanding spring-barbed fangs, in combination with one, two, or more exploding barrels."

111. For an *Improvement in Fountain Pens;* Charles A. Rosefield, Columbus, Georgia.

Claim.—"The detachable quill conductor fitting laterally in or to a rigid upper conductor or conductor holder, arranged to freely swivel on a centre pin or bearing at the bottom of or below the reservoir, for action with the pen and pen holder."

112. For an *Improvement in Binding Books;* Archibald H. Rowand, Allegheny, Pennsylvania.

Claim.—"The combination of the rollers in the groove or book carriage, as applied to books, to aid in moving them in their racks in a vertical position. Also, the application of the spring, used in compressing the extremities of the arch of the head band, and thereby causing said head band to maintain a circular or arch-like form, by means of which the leaves of a folio or book are kept from dropping or saging when the book is in a vertical position; this spring I use according to convenience or choice, either applied on the outside of the outer back or next to the head band, or inclosed between the outer and inner backs."

113. For an *Improvement in Bumper Railroad Car Brakes;* Louis Brauer, Sommerville, Tennessee.

Claim.—"The sliding bumper, in connexion with clamp and stop-piece. Also, the elastic hinge within the tapering sleeve."

114. For an *Improved Machine for Planing Chair Seats;* Edward Q. Smith, Cincinnati, Ohio.

Claim.—"The combination by means of the universally jointed shaft of the feed-wheel, with the eccentric, when the said wheel derives its motion from the chair seat."

115. For an *Improvement in Heating Soldering Tools by Gas;* J. Henry Stimpson, Boston, Massachusetts.

Claim.—"The perforated cylinder enclosing the soldering copper, in combination with the cylinder or chamber, which concentrates the heat. Also, detaching the soldering tool, and regulating the supply of gas by compressing the pipe."

116. For an *Improved Portable Field Fence;* Seth C. Tufts, Mainville, Ohio.

Claim.—"Supporting the panels vertically upon the coupling blocks. Also, providing the chairs with upright cleets."

117. For an *Improved Soap Substitute for Scouring Woolens;* Louis Wilman, Worcester, Massachusetts.

Claim.—"The fulling and felting liquid composition, composed of soda ash, salt, and bran."

118. For an *Improvement in Rock Drills;* John D. Hope, Niagara Falls, N. Y., Assignor to G. Arthur Gardner, City of New York.

Claim.—"The formation and shaping of the wings or ridges on the transverse corners of the drill."

119. For an *Improvement in Seed Planters;* Charles Ketchum, Assignor to Charles G. Judd, Penn Yan, New York.

Claim.—"The blades, in combination with the bolts. Also, the adjustable cylinder in combination with the band and sack."

120. For an *Improved Sub-marine Excavator;* William Kennish, Brooklyn, N. York, Assignor to Andrew B. Gray, San Diego, California.

Claim.—"1st, The combination and arrangement of the chambers with their pipe,

valves, weights, or of any equivalent thereof. 2d, The arrangement of the cylinders with their pipes and hose, or their equivalents, whereby the mud chamber and floating chamber are alternately filled with, or emptied of, air, as the means of collecting and floating off the excavated material."

121. For an *Improvement in Copying Presses;* Wm. Morris Smith, Assignor to self and Peter Hannay, Washington, D. C.

Claim.—"1st, The levers, in combination with the links. 2d, The method of adjusting the platen and bed plates, so as to take a book of greater or less thickness. 3d, The slotted upright on the bed plate, in combination with the arms of the platen for the purpose of preventing lateral motion."

122. For an *Improved Method of Preparing Canvass for Printing, Painting, &c.;* Elisha Lee, Baltimore, Maryland.

Claim.—"The composition of the above ingredients to produce an oil ground, possessing the before mentioned qualities, without sizing the canvass."

123. For an *Improvement in Gas Generators;* James A. Bruce, Assignor to the Maryland Portable Gas Company, Baltimore, Maryland.

Claim.—"The new and improved gas retort with smoke attachment, by which atmospheric air is admitted at bottom to clean, and purifying material by combustion."

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124. For an *Improvement in Cordage Machines;* James P. Arnold, Louisville, Ky.

Claim.—"The combination of a series of two or more pulleys, each pulley arranged to rotate on its own axis, and to revolve around a centre common to all, with a ring concentric to said circle of revolution, whose surface, adjacent to the pulleys, is elastic and forms a track for the pulleys to roll on."

125. For an *Improvement in Port-folios;* Robert Arthur, Philadelphia, Penna.

Claim.—"1st, A port-folio made with an elastic back or hinge, combined with an elastic fastening. 2d, Making the hinge and fastening adjustable."

126. For an *Improvement in Projectiles;* Christopher C. Brand, Norwich, Conn.

Claim.—"The improved fuse tube or plug, as constructed, with two plug chambers separated by a breech or partition. Also, the improvement of making said tube with an encircling chamber or recess."

127. For an *Improved Arrangement of Devices for Dressing Pieces of Lumber;* Harvey Brown, City of New York.

Claim.—"The movable frame, or its equivalent, as supporting the planer and the jointer, which, by means of the set screws, connect it with the frame, by which arrangement pieces for barrel heading or other purposes can be sawed, planed, and jointed simultaneously, of any desired thickness or width, within the compass of the machine."

128. For an *Improved Hand Truck;* Ze Butt, Lincolnton, North Carolina.

Claim.—"The manner of constructing, arranging, combining, and operating the dumping truck, or any other manner or method essentially the same."

129. For *Improved Devices for Dogging Lumber in Planing Machines;* David N. B. Coffin, Jr., Newton, and Henry D. Stover, Boston, Mass.

Claim.—"The bar, constructed and arranged in combination with the rack, or its equivalent. Also, the device for the rear end of the platen, so constructed and arranged that the dogging bars are clamped firmly to the platen, at same time that they adjust themselves to the form and position of the end of the lumber, by the operation of a single screw."

130. For an *Improved Machine for Gathering and Depositing Dipped Matches;* Thomas Cook, City of New York.

"The invention consists of a means for automatically discharging the matches from the 'dipping boards,' and depositing the same into the boxes, without said matches requiring any handling by the workman."

Claim.—"The method of feeding the 'dipping boards' in connexion with the operation of the discharging pins. Also, the receiving table, with its gathering and deliver-

ing blocks, in combination with the aforesaid means for conveying and discharging the matches from the 'dipping board.' "

131. For an *Improvement in Gas Regulators;* Robert Cornelius, Philadelphia, Penna.

Claim.—"The employment of the auxiliary spring box, communicating directly with the main chamber, in combination with the valve communicating with the middle chamber, for the purpose of preserving the uniform action of the regulator under considerable variation in the main pressure."

132. For an *Improvement in the method of Treating Straw Braid for Hats, &c.;* George Cornwall, 2d, Milford, Connecticut.

Claim.—"The method of simultaneously beveling, curving, stretching, and smoothing the braid."

133. For an *Improvement in Piano-forte Actions;* Spencer B. Driggs, City of N. Y.

Claim.—"Balancing or placing the centres of motion of the keys at, above, or near the top thereof, instead of at the bottom or centre."

134. For an *Improvement in Gunpowder;* Lammot Dupont, Wilmington, Del.

Claim.—"The manufacture of gunpowder by the use of nitrate of soda, and the glazing of the powder so made."

135. For an *Improved Blanket for Calico Printing Machines;* John Fallon, Lawrence, Massachusetts.

Claim.—"The combination of the short india-rubber blanket, with the multiple fold of 'greys' passing once through the machine."

136. For an *Improvement in the Shuttle Motion for Looms;* Levi Ferguson, Lowell, Massachusetts.

Claim.—"The combination of the rest carried by the rock shaft, the curved sliding guide rod, connected with the picker staff and the box, attached to the rock shaft, the latter serving not only to guide the sliding guide rod, but also to contain the spring by which the picker staff is thrown back after throwing the shuttle."

137. For an *Improvement in Violins;* Bradley Fitts, Charlton, Massachusetts.

Claim.—"The application of bells within the interior of, or behind the sounding board of a violin, or other stringed musical instrument."

138. For an *Improvement in Machines for Cleaning Grain;* J. R. Gates, Eckmansville, Ohio.

Claim.—"The box, divided into two compartments by the partition, the fan box, and scouring box, provided with the stones and rotating beaters, when the above parts are arranged relatively with each other: it being understood that I do not claim separately either of the parts, but all the said parts when arranged and combined so as to operate conjointly."

139. For an *Improvement in Machines for Re-dressing Mill-Stones;* W. Y. Gill, Henderson, Kentucky.

Claim.—"The combination of two or more picks, with the guiding and operating screw-shaft and lifting cams."

140. For an *Improvement in Pumps;* Silas Hewit, Seneca Falls, New York.

Claim.—"The arrangement of the tubes, piston head, and valves."

141. For an *Improvement in Grain and Grass Harvesters;* John H. Keyser and Edward M. Mobley, Hagerstown, Maryland.

Claim.—"Operating the cutter bar from the driving-wheel, by means of a fork and arm, in combination with rocker and slotted arm, when said parts are constructed and arranged to operate in relation to each other."

142. For an *Improved Machine for Making Wash-boards;* Edward and Britain Holmes, Buffalo, New York.

Claim.—"1st, Increasing both stiles of the wash-board at the same time, and also entering the zinc into the incision in both stiles at the same time. 2d, Raising and lowering the end of the sliding arm at its connexion with the vibrating lever, for the purpose of controlling the number of blows to be given by the drivers, and the forces

thereof. 3d, The combination of the expanding iron frames, with the wedge and cutters. 4th, The combination and arrangement of the series of levers with the pin and spiral spring, and hook, or their equivalents. 5th, The combination of the spiral spring (or its equivalent.) with the lever and rod, for the purpose of continuing the movement of the lever after the incision is made in the stiles, and the cutter withdrawn, so that the stiles will be carried to the zinc, and the zinc entered in the incision made by the cutters. 6th, The application of the eccentric in connexion with the lever and its arrangements (or its equivalent,) for the purpose of applying power to make the incision in both stiles of the wash-board at the same time, and also to facilitate the entrance of zinc into both stiles at the same time."

143. For an *Improved Process for Removing Photographs from Glass to Paper;* Edward Howell, Ashtabula, Ohio.

Claim.—"The mode of transferring a positive impression from glass plate to paper, or other desired substances, by means of a coating of bees-wax upon the glass plate."

144. For an *Improved Mode of Fastening Sheet Metal on Roofs, &c.;* Asa Johnson, Cairo, Assignor to self Wm. Highie, and Henry Link, Little Falls, New York.

Claim.—"The self-adjusting fastener for the purpose of attaching metallic covering to buildings, and accommodating itself to the contraction and expansion of the metal, and for the fastening metals in any and all other places where the contraction and expansion demand accommodation, or any mechanical device equivalent thereto."

145. For an *Improved Joiners' Plane;* James Lashbrooks, Owensborough, Ky.

Claim.—"The curved plane iron and cap, in combination with the curved back-rest and slotted plate."

146. For an *Improvement in Friction Rollers for Journals of Shafts, Axles, &c.;* William H. Main, Litchfield, Ohio.

Claim.—"Arranging the two series of friction wheels at any suitable angle with the line of the journal, so that when they, the said wheels, are placed in a suitable box or wheel, the journal of said shaft may be supported and braced in all directions; the friction wheels having their journals supported by a series of embracing rings, which thus form their rolling bearings."

147. For an *Improvement in Machinery for Dressing Sewing Thread, Warps, or Yarns;* J. D. Minder, Killinghy, Connecticut.

Claim.—"The employment for dressing sewing thread and yarns of a series of straight brushes, arranged in pairs, and having a crank motion towards and from each other, so that the several pairs engage and move together along the thread or yarn."

148. For an *Improved Approach Opening Gate;* George W. McGill, Buffalo, N. Y.

Claim.—"The combination of levers, rack, and cog-wheel, for operating a gate."

149. For an *Improved Apparatus for Reducing Zinc Ores;* Alfred Mounier, Camden, New Jersey.

Claim.—"The combination of the gas generator and the reducing furnace."

150. For an *Improvement in Running Gear of Carriages;* Richard Murdoch, Baltimore, Maryland.

Claim.—"Giving to the brace levers a forward and outward projection from the short axles."

151. For an *Improved Valvular Arrangement in Apparatus for Raising Water;* Andrew Nicol, Carbondale, Pennsylvania.

Claim.—"The rods provided with the valves, and operated in combination with the chambers or vessels, suction pipe, and branch pipes, and the tubes provided with the valves."

152. For an *Improved Basin Faucet;* Erastus Stebbins, Chickopee, Mass.

Claim.—"Combining and arranging the tubular bearer with the spindle, the valve case, and adjusting screw. Also, the combination and arrangement of elevating and depressing cams, (or their equivalents,) and the plane or bearing surfaces, the same being applied to the spindle and valve."

153. For an *Improved Rotary Planing Cutter;* Henry D. Stover, Boston, Mass.

Claim.—"My method, or its mechanical equivalent, for securing double or single cutting irons to cutter heads, to hold them secure when in use."

154. For an *Improvement in Lifting Jack;* William Thomas, Hingham, Mass.

Claim.—"The retaining pawl, provided with the weighted arm, attached to the standard, arranged relatively with the pawl and catch."

155. For an *Improved Shirt Stud or Button;* Wm. Voght and John J. Klink, Louisville, Kentucky.

Claim.—"Shirt studs or buttons, sleeve buttons, breast pins, or any other article of jewelry or ornament, made with the bar and the hook."

156. For an *Improved Device for Allowing Play to the Arbors of Circular Saws;* Harvey R. Wolfe, Louisville, Kentucky.

Claim.—"The bar or lever having an elastic and a stiff or rigid portion, and pivoted to the bar; the elastic end of the bar or lever being connected with the saw arbor or shaft, and the stiff or rigid part with the sliding guide through the medium of the rod and lever, whereby the bar or lever performs the double function of spring and lever; the saw and guide being both moved laterally when necessary, by actuating the bar or lever, and when the outer end of the bar or lever is secured or made permanent, the inner end or part serving as a spring to allow the saw an independent lateral play or movement."

157. For an *Improved Centrifugal Battery;* Albert Potts, Philadelphia, Penna.

Claim.—"The combination."

158. For an *Improvement in Stencil Plate Printing;* Samuel T. Sanford, Fall River, Massachusetts.

Claim.—"Having the stencil plate made in the form of an endless belt."

159. For an *Improved Machine for Compressing the Ends of Blind Slats;* Luther T. Smart, Manchester, New Hampshire.

Claim.—"The machine, or its equivalent, for crimping shades to blinds, consisting essentially of the sliding dies, in combination with the cams, the rods, the slide, and the pressure studs, with the rack connected together."

160. For an *Improved Arrangement of Safety Valves within Steam Boilers;* George P. Clarke, Assignor to self and Wm. M. Littell, Newark, New Jersey.

Claim.—"The arrangement of the inverted valve in globe, pressed to its seat by the spring from below, the clevis and the escape pipe extending through the boiler, all constructed and arranged within the boiler."

161. For an *Improvement on Apparatus for Indicating the Speed of Vessels and Depth of Water;* David Hinman and F. B. Fournier, Berea, Ohio, Assignor to selves and R. I. Parker, Ogdensburg, New York.

Claim.—"The arrangement of the movable wing, with its joint, the rod and rack combined, with the dial or indicator."

162. For an *Improved Method of Printing in Colors;* William Croome, Brooklyn, New York.

Claim.—"The movable tablets for the separate colors, in combination with the guided roller, or equivalent surface, for taking up the inks. Also, in combination with the printing surface, and with the inking surface, the corresponding guides for ensuring the uniform action of the inking surface upon the printing surface."

163. For an *Improvement in Mowing Machines;* Thomas Harding, Assignor to Warder, Brokaw & Child, Springfield, Ohio.

Claim.—"The combination with a mowing machine of the peculiarly constructed truck, when both are arranged to operate in relation to each other."

164. For a *Combined Lantern and Oil Can;* Wm. G. Russell, Assignor to self and Wm. Sewell, City of New York.

Claim.—"The attachment of a lamp or light to an oil can or feeder, for illuminating the place to be oiled."

165. For an *Improvement in Machines for Folding Paper;* Edward N. Smith, Springfield, Assignor to Stuben S. Bacon, Boston, Massachusetts.

Claim.—"1st The employment of points or register pins, or their equivalents, for the purpose of correctly presenting sheets of paper to a folding apparatus. 2d, The manner of adjusting the register pins, and their peculiar movement. 3d, Combining with the knives or straight edges, or their equivalents, the points projecting beyond the edge thereof, for steadying the sheet while being folded. 4th, Reducing the speed of the succeeding sets of rollers from first to last, so as to proportion the distance traversed by the sheet at each succeeding fold to the reduction of its size, so that the time the sheets are moving from point to point shall be equal or nearly so. 5th, The adjustable stop for determining the proper position of the sheet to receive its second and succeeding folds. 6th, The combination of the fly with the folding apparatus for laying off the folded sheets."

166. For an *Improvement in Looms;* Nathaniel B. Carney, Assignor to John B. Livingston, Charles H. Haswell, and Russell C. Root, Trustees, City of New York.

Claim.—"1st, The weaving of fabrics within and upon a circular frame or looms, arranged about a common centre, producing the fabric at the central part, the shuttles being carried in a circle round the frame or loom in a continuous movement, the warps, shuttles, and filling being placed at the top of the loom, and the machinery for operating acting underneath, the weaving being effected by machinery. 2d, The combination and arrangement of the machinery acted upon and driven by the spur-wheel, and its eccentric grooves and their connexions, by which the sliding frames holding the warp wires or heddles are caused to reciprocate in opposite directions in equal times and regular succession, and the shuttles are made to rotate about the circumference of the loom, in a plane perpendicular to the planes of motion of the sliding frames, and in equal times, so as to pass between the upper and lower sets of warp threads when apart, thus producing a fabric at the central point. 3d, The combination of the roller covers and barrels. 4th, The combination and arrangement or mechanism of the flat wheels or disks, with their grooves, with eccentrics, the cams and connecting rods, and slides, the roller covers, the levers, bolts, and slides, the levers carrying a motion from the rollers and covers to the warp wires, so as to hold them fast or set them free to move with the frames, the whole operating in conformity with, and its connexions thereby regulating the pattern, shape, or figure, of the fabric to be woven. 5th, The giving to the shuttle the same continuous line of motion, without any divergence, thus avoiding the danger of injuring the operator or the fabric from an accidental false direction of the shuttle. 6th, The form and construction of the shuttle, having its teeth on the under side or outside of its arc, and also, the shuttle constructed so as to adapt itself to the increasing growth of the fabric, and pressing up the filling."

167. For an *Improved Spring Hinge;* Dr. Joseph S. Smith, City of New York; ante dated May 12, 1857.

Claim.—"The use of the centre pin, and capped springs, constructed, secured, and operated within the tubular knuckle, having a double lapped joint."

168. For an *Improved Electro-magnetic Fire Alarm Telegraph for Cities;* Wm. F. Channing, Boston, and Moses G. Farmer, Salem, Massachusetts, Assignors to Wm. F. Channing, aforesaid.

Claim.—"1st, The signal system, consisting of a series of signal stations, scattered at short intervals through a whole city or town, or any part thereof, and telegraphically connected with a common centre or point, or with each other, by one or more signal circuits, by which means a constant communication may be established and maintained between all parts of a city or town, however extended, and with the centre or centres at which the signal circuit or circuits converge or meet, so that the moment a fire occurs, its existence and locality may at once be known at the centre of the system, and efforts for subduing it properly directed. 2d, The alarm system, consisting of a series of alarm stations suitably distributed throughout a whole city or town, or any part thereof, and telegraphically connected with a central station by one or more alarm circuits, by which means a public alarm of the existence and locality of a fire may be given at different points. 3d, In combination with the alarm system for striking the number of the district upon the alarm bells, the signal aystem for communicating the number of the station at which the fire occurs to all the signal stations, as well aa for communicating an alarm to the central station."

169. For an *Improved Shingle Machine;* C. M. Young, Sinclearville, New York.

Claim.—"Operating or giving the necessary feed motion to the block and bolt, by means of the laterally reciprocating bar actuated by the eccentric grooves in the wheels, the bar vibrating the block through the medium of the bar, the block being provided with pawls which catch into the racks in the frame. Also, the saws placed in the frame or sash, which is secured at the back of the gate, and operated from the bar. Also, the bar when arranged so as to be driven or operated from the gate, whereby the several parts of the machine are all made to work automatically."

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170. For an *Improvement in Spinal Corsets;* Alanson Abbé, Boston, Mass.

Claim.—"My improved manufacture of corset for the cure of spinal deflexions, the same being made with counteracting springs, constructed and arranged laterally and longitudinally in the back portion thereof."

171. For an *Improvement in Mowing and Reaping Machines;* Amory Amsden, Rochester, New York.

Claim.—"The combination of a continuous helix with the cutters, when said helix forces the grass or grain against the cutters in a direction transverse to the direction in which the helix revolves."

172. For an *Improved Construction of Vehicles;* Charles Atkinson, Danville, and Gilbert S. Manning, Springfield, Illinois.

Claim.—"The construction of the vehicle, viz: the two pairs of springs attached to the ends of the front and back axles, the springs of the back axle being attached directly to the bed, and the springs of the front axle attached to the bed by the ball and socket joint, the inner ends of said springs being attached to a plate provided with a friction roller, which rests or bears upon a segment guide. We only claim the several parts when considered as a whole."

173. For an *Improvement in Revolving Fire Arms;* Fordyce Beals, New Haven, Connecticut.

Claim.—"Making the spring catch by which the cylinder is locked in position for the discharge to conform to the periphery of the cylinder, and project in front of the recoil shield on one side of the cylinder, for the purpose of serving as a resting place or seat to hold the cylinder in place for the insertion of its central arbor."

174. For an *Improvement in Griddles;* Wm. Bennett, City of New York.

Claim.—"The griddle and its ventilating cover, the former being constructed with a flaring flanch, opening *b*, sliding register *c*, and openings *d*, and the latter with an enlarged opening and flue."

175. For an *Improved Hand Seed Planter;* Silas P. Briggs, Saratoga Springs, New York.

Claim.—"The set or fastener, in combination with the plunger."

176. For an *Improvement in Grain Scourers and Separators;* Samuel Canby, Ellicott's Mills, Maryland.

Claim.—"The series of scouring disks and self-adjusting conical rubbers on the same shaft, and alternating with the disks, in combination with the hoppers, performing the double function of rubbing and concentrating the grain, the perforated casing surrounding all of the disks except the lower, and the tight outer casing arranged and operating to effect a progressive cleaning and final separation of the grain."

177. For an *Improved Machine for Cutting and Bending Sheet Metal;* Elias F. Coates, Mystic Bridge, Connecticut.

Claim.—"The cutting and bending of sheets of tin or other metal for roofs, by one operation, and through a combination of devices."

178. For an *Improvement in Means for Reefing Top-sails;* James E. Cole, City of New York.

Claim.—"The supplementary shaft, in combination with the roller spar."

179. For an *Improvement in Sewing Machines;* Solomon B. Ellithorp, City of New York.

Claim.—"The attachment of the primary moving power to give motion to the needle in direct communication with the needle stock, and in vertical line with the needle."

180. For an *Improved Tongue and Castor Plate for Harvesting Machines;* Ralph Emerson, Jr., Rockford, Illinois.

Claim.—"The tongue and castor plate."

181. For an *Improvement in Curtain Rollers;* Chandler Fisher, Milton, Mass.

Claim.—"The employment of a spring, in combination with the pivot of a curtain roll, for the purpose of producing friction between the roll and the window frame, and thereby holding the curtain in any position in which it may be placed."

182. For an *Improvement in Wagon Couplings;* W. D. Guseman, Morgantown, Va.

Claim.—"Coupling the hind and fore wheels of a wagon, by means of an adjustable reach, and a correspondingly adjustable piece on the front hounds, to which the rear hounds are pivoted."

183. For an *Improved Bomb Lance;* Julius Grudchos and Selmar Eggers, New Bedford, Massachusetts.

Claim.—"The arranging the tube; the arranging the trigger, the trigger spring, the sear spring, the main spring, the hammer, the tube. Also, applying the grooved ball for the purpose of giving the lance a rotary motion to prevent it striking sidewise."

184. For an *Improvement in Cooking Stoves;* Joseph Hackett, Louisville, Ky.

Claim.—"The employment in combination with the dampers of the oven and doors, of a rising and falling catch bar, which has a turning knob, which is so arranged that in turning it shall rise over an inclined plane or stationary stop on the door."

185. For an *Improvement in Registering Apparatus for Printing Presses;* Gordon McKay, Boston, Massachusetts.

Claim.—"The use of brushes, or equivalents, when automatically operated and combined with register points."

186. For an *Improved Sugar Boiling Apparatus;* Adolph Hammer, Reading, Pa.

Claim.—"The peculiar arrangement of pipes, whereby the steam is caused so to travel as to force one continuous and unbroken stream through the pipes, and to form a proper compensation or equalization of temperature throughout the whole surface of the coil."

187. For an *Improvement in Ink-Stands;* Bennett J. Heywood, London, England; patented in England, January 16, 1856.

Claim.—"The means of forcing ink into the fountain of ink-stands, by the combined action of the lower valve and the aperture in the top plate or disk, which acts alternately as a closed and open valve by the application and removal of the finger."

188. For an *Improvement in Ore Crushing Machines;* Samuel F. Hodge, Detroit, Michigan.

Claim.—"The alternate lifting and dropping of a stamper hammer, or any weight, by means of a combination of a vertical rod with two clamping rollers, the periphery of one of which is not a complete circle."

189. For an *Improvement in Looms;* Wm. H. Howard, Philadelphia, Penna.

Claim.—"The holding of the threads of weft and warp in a web of cloth, extended by combs applied to the selvedges and warp threads thereof, or by any other equivalent mechanism."

190. For an *Improvement in Apparatus for Discharging Horse and Shafts from a Carriage;* Gilbert Hubbard, Sandersville, Massachusetts.

"The object of my invention is to enable a person who may be in a carriage with which a horse is running away, to free the body and wheels, or running parts, from the shafts and horse; also, to provide the shafts with a means by which when they are detached from their carriage, their rear ends may be maintained at such a height above the ground as to prevent their cross-bar from falling on the horses' hind legs, and doing injury thereto."

Claim.—"The shaft rest or legs, in combination with the shafts and bolting apparatus, and operated thereby for the purpose of supporting the shafts after their detachment from the carriage. Also, the combination and arrangement of mechanism for attaching the shafts to, and detaching them from the axle connexions such combination consisting of the bolts, the sectors, the turning lever frame, and the rotary foot cam, connected and made to operate together. Also, the combination of the lever and hold fast cam, with the turning pawl, and the slider connected with the latter."

191. For an *Improvement in Washing Machines;* Abraham Huffer, Hagerstown, Md.

Claim.—"The arrangement of slotted levers, and upright springs, connected and operated upon by the pulley taps, pulley cord, shaft, and crank, for the purpose of facilitating the parallel adjustment."

192. For an *Improved Shingle Machine;* Wm. A. Jarrett, Patonsville, Tennessee.

Claim.—"Elevating and depressing the knife, and retaining the same in the required position, by means of the bar on the bottom of the carriage operating upon the cams of studs. Also, the automatic apron, whereby the shavings are all taken from the shingles and knife, and thrown from the machine, the apron returning successively to a horizontal position to receive the shavings.'

193. For an *Improvement in Reels for Yarn or Thread;* Christian Knauer, Pittsburgh, Pennsylvania.

Claim.—"The combination of the plates provided with the ratchet and pawl, the curved arms, and swivel guide."

194. For an *Improvement in Corn Planters;* Robert Kuschke and Peter Merkel, St. Louis, Missouri.

"The invention consists in planting corn by means of movable boxes, which by passing on a frame to and fro, drop the necessary number of corns at every four feet through a hole in the bottom, and through a corresponding hollow planter into the ground."

Claim.—"The reciprocating seed boxes, arranged and operated."

195. For an *Improvement in Sizing Compositions for Yarns, Paper, &c.;* John Leigh, Manchester, England.

Claim.—"The sizing and dressing of yarns, woven goods, and paper, by means of the alkaline silicates."

196. For an *Improvement in Fire Arms;* Edward Lindner, City of New York.

Claim.—"The construction, arrangement, and operation of the rack, when composed of a series of cones superposed to each other, the bases of said cones bearing upon studs that propel the cartridges in one or more charge barrels ranged round said rack. Also, revolving the breech piece by the mechanism, when arranged to act upon the interior surface. Also, the plate placed in front of the breech chamber, for the purpose of retaining the cartridges in said chambers which do not face the barrel. Also, the knee-piece, in combination with the hammer and stop-bolt, the said parts being so arranged in relation to each other, that by the act of cocking the gun, the stop-bolt shall be withdrawn from the recesses of the breech, thus leaving it free to revolve."

197. For an *Improved Hydro-dynamic Machine for Testing Strength of Materials;* Francis C. Lowthrop, Trenton, New Jersey.

Claim.—"The combining of gearing and other suitable mechanism for applying strains or forces to the object to be tested, with a piston or plunger, operating against a body of water within a cylinder or barrel, in such a manner that on applying the said force or strain, such a pressure shall be transmitted to the fluid and to any suitable indicator communicating with the same, that the amount of strain or force on the object may be readily calculated."

198. For an *Improved Wind-Wheel;* James Mitchell, Woodsfield, Ohio.

Claim.—"1st, Placing the arms of the fans obliquely, so as to have a proper degree of inclination with the shaft. 2d, Attaching the arms to the levers, and connecting said levers to the sliding collars, for the purpose of adjusting the arms more or less obliquely with the shaft."

199. For an *Improved Ore Washer;* Pierre P. Martin, Paris, France; patented in France, May 13, 1856.

Claim.—"The general arrangement of the apparatus."

200. For an *Improved Repeating Fire Arm;* Wm. W. Marston, City of New York.

Claim.—"The combination of the exploder and cylinder, actuated by the dog, or its equivalent, to explode successively the barrels arranged vertically over each other."

201. For an *Improvement in Making Paper Pulp;* Marie A. C. Mellier, Paris, France; patented in France, August 7, 1854; patented in England, October 26, 1855.

Claim.—"The use of a solution of caustic soda (*n a o*) in a compartment of a rotary vessel separate from that which contains the steam heat. Also, the process for bleaching straw, consisting in boiling it in a solution of pure caustic soda (*n a a*) from 2° to 3° Beaumé, at a temperature not less than 340° Fahrenheit after it has been soaked and cleaned, and before submitting it to the action of a solution of chloride of lime from 1 to 1½ degrees."

202. For an *Improvement in the Manufacture of Iron and Steel;* Robert Mushet, Coleford, England; patented in England, Sept. 22, 1856.

Claim.—"The addition of a triple compound or material of or containing iron carbon and manganese to cast iron, which has been purified and decarbonized by the action of air whilst in a molten or fluid state, or in any convenient manner so as to become mixed and combined in the process of manufacture, in order by the union of these substances to obtain malleable iron and steel."

203. For an *Improvement in Brick Machines;* Stephen Parks, San Francisco, Cal.

Claim.—"Feeding the moulds to or underneath the moulding or press-box, and also discharging them therefrom by means of the reciprocating and swinging cross-head, operated by the rods, connected with the slides, and the shafts, when used in combination with the pivoted inclined planes and projecting arms."

204. For an *Improvement in Cotton Cultivators;* Alexander A. Roberts and Baldwin Davis, La Grange, Georgia.

Claim.—"In combination with the frame and brake, the movable frame armed with hoes and a harrow, the teeth of said harrow being so arranged as to cultivate between the bunches of cotton, and at the same time clear the standing cotton plants from clods, &c."

205. For an *Improvement in Fertilizing Compounds;* Louis S. Robbins, Brooklyn, New York.

Claim.—"The new composition of matter obtained by the intimate mixture of green sand and super-phosphate of lime in a finely pulverized form."

206. For an *Improvement in Machines for Making Stove Pipe;* M. C. Root, Toledo, Ohio.

Claim.—"The arrangement and combination together of the edging, grooving, forming, swaging, and expanding, and contracting, rollers. Also, giving a spiral form to the groove of roller."

207. For *Improved Machinery for Compressing Gaseous Bodies;* Wm. A. Boyce, Newburgh, New York.

Claim.—"The apparatus for compressing and packing gaseous media."

208. For an *Improved Bit for Cutting Out Cylindrical Plugs of Wood;* Cyrus W. Saladee, Columbus, Ohio.

Claim.—"The projecting lips or cutters, for the purpose of cutting out round plugs of wood."

209. For an *Improvement in Apparatus for Examining Vessels' Keels;* James E. Simpson, East Boston, Massachusetts.

Claim.—"The apparatus for examining keels of vessels, consisting essentially of the levers and rods."

210. For an *Improvement in Corn Planters;* F. J. Smith, Four Corners, Ohio.

Claim.—"The combination of the rods and cut-off plates, with the springs and the inclined recesses in the tongue."

211. For an *Improved Machine for Cutting Grooves and Slots;* Robert F. Underhill, Indianapolis, Indiana.

Claim.—"1st, Forming cutting edges on the outer ends of the cogs of cog-wheels.

2d, The combination of the cutter as constructed, the cogged wheels, the shaft, and the slotted arbor, with the adjustable wedge and table, or any equivalent device."

212. For an *Improved Tanning Apparatus;* Otis B. Wattles, Haddington, New York.

Claim.—"The hides laced in the frame entirely around its border, and sustained vertically in the vat."

213. For an *Improvement in Sewing Machines;* Thomas S. Wells, Utica, New York.

"This invention relates to that description of sewing machines, in which the sewing is effected by a needle with a point at each end, passing entirely through the cloth or other material to be sewed, from opposite sides, alternately. It consists in certain means of taking up the slack of the thread, which prevents it catching or tangling, and admits of a longer needle full of thread being used than is admitted in machines of the same kind as heretofore constructed. It also consists in an improvement in the needle, by which facility is afforded for inserting the thread, and at the same time provision is made for securing the end of the thread therein."

Claim.—"1st, The employment of a wheel to carry the finger, and take up the slack of the thread on its periphery, as it is drawn through the cloth in tightening the stitch. 2d, Enclosing the wheel within a case to prevent the thread slipping off the wheel, and to guide the slack while it is being drawn through the cloth in the production of the successive stitches."

214. For an *Improved Thermo-Pneumatic Safety Valve;* S. H. Whitaker and Ezra Cope, Cincinnati, Ohio.

Claim.—"The self-acting air valve, consisting of a chamber whose top is composed of a flexible diaphragm, or its equivalent, filled with bees-wax, or other fusible substance, that solidifies at atmospheric temperatures, but is expansible by heat, and that will act upon the diaphragm to open and close the passage through the combined agencies of expansion and contraction by heat, gravitation, and cohesive attraction."

215. For an *Improvement in Seed Planters;* Jesse Whitehead, Manchester, Virginia.

Claim.—"The combination of the trough with its spout and receptacle, when used in connexion with a seeding apparatus, for the purpose of dividing and retaining the excess of seed from that which is to be planted."

216. For an *Improved Compound Gauge;* Albert Williams, Philadelphia, Penna.

Claim.—"The combination of the four several gauges in one tool, and all operating on the same end of the stem, the mortise working with an anti-friction screw, the head of which is at the bottom or end of the stem."

217. For an *Improvement in Looms;* Franklin Painter, Assignor to The Nashuawannock Manufacturing Co., East Hampton, Massachusetts.

Claim.—"1st, A divided or sectional reed. 2d, In combination with such, a divided or sectional reed, a take up motion or apparatus which is thrown out of action at certain proper periods. 3d, A pattern barrel, or its equivalent, in combination with vibrating levers. 4th, An apparatus, viz: a pattern barrel, or its equivalent, in combination with a primary pattern barrel, or its equivalent, arranged in such manner, that the former shall at proper times present the selection of heddles or leaves of heddles by the latter. 5th, A latch. 6th, A divided reel, in combination with proper mechanism for forming a shed on one side only of a slit or button at the same time. And, lastly, a primary barrel for selecting heddles or leaves thereof, in combination with a secondary pattern barrel for preventing their selection, and vibrating levers acted upon by both barrels, or the equivalents of these parts in combination, each acting in combination with the others."

218. For an *Improvement in Printing Presses;* S. D. Learned, Boston, Mass., Assignor to A. C. Learned, City of New York.

Claim.—"The reciprocating frame provided with the inking and presser rollers, in combination with the ink and form beds, and tympan, provided with the rods and frisket, the above parts being arranged to operate conjointly."

219. For an *Improvement in Burglars' Alarms;* David Coon, Assignor to self and B. F. Chesborough, Ithaca, New York.

Claim.—"1st, So attaching the barrel of the pistol to its stock or plate, at or near

the muzzle, as to make a hinge joint at or near that point. 2d, The combination of spring plate, tumbler, and barrel, by which the barrel becomes the hammer, constructed so that when the pistol is properly fastend to the casing of the door, the barrel being cocked, shall be at such an angle, or in such a position, that the door on opening must necessarily press upon it, and thereby discharge the pistol, the contents passing outwards."

220. For an *Improved Projectile for Killing Whales;* Rufus Sibley, Assignor to Christopher C. Brand, Norwich, Connecticut.

Claim.—"An improved projectile (to be fired from a gun,) constructed with sheet metal wings, having journals, or turning on wires or journals, arranged so that the said wings may be turned down transversely or laterally on the body of the projectile, or in a recess or space made therein to receive them, each wing being arranged either parallel or inclined to the axis of the projectile."

221. For an *Improvement in Machines for Cutting India-Rubber, Gutta-Percha, and other Boot and Shoe Soles;* Stephen Thurston, Assignor to self, Marcus L. Ward, and Huntington & Co., Newark, New Jersey.

Claim.—"The combination and arrangement of the cutter cylinder and carrying cylinder, the cylinder being moved forward by the action of the cutters upon it, and moved backward by the eccentric on the cutting cylinder."

222. For an *Improvement in Tips for Sugar Moulds;* John Turl, City of New York, Assignor to Samuel Turl, Brooklyn, New York.

Claim.—"The construction of the tip with a recess to receive the body of the mould, and with a conical mouth opening in a contrary direction to the regular conical form of the interior of the mould."

223. For an *Improvement in Securing Nuts on Axles;* Thomas W. Williams, Assignor to self and Henry T. Hoyt, Philadelphia, Pennsylvania.

Claim.—"Securing nuts upon axles by means of the lever-key, and the mortises or recesses, the same being constructed and arranged so as to operate together."

224. For an *Improvement in Drop Presses;* Milo Peck, New Haven, Conn.

Claim.—"The combination of the male and female wheels with the sweep shaft, the ratchet wheel, the dog, and the guard ring, or their equivalents, so that the fall of the drop can be regulated and controlled. Also, the movable guard ring, in combination with the sweep shaft, the ratchet wheel, and the dog, or their equivalents, by means of which the time the drop shall remain upon the anvil can be regulated and controlled."

RE-ISSUES.

1. For an *Improvement in Turn Tables;* Jacob C. Robie, Binghampton, New York; patented August 15, 1854; re-issued May 5, 1857.

Claim.—"Balancing the platform of the turn table upon a transverse shaft, or other suitable bearing or bearings, resting upon, or connected with, the carriage which supports said platform, in such manner that the table, when in a horizontal position or thereabouts, is elevated above its under supports or end bearings, to admit of its free swing, and so that the table may be depressed at either end to bring the ends of its rails on either side of the carriage into line or level with the rails of the track."

2. For an *Improvement in Looms for Weaving Brussels Carpets, &c.;* Erastus B. Bigelow, Boston, Mass.; patented March 10, 1849; re issued Oct. 9, 1849; re-re-issued May 5, 1857.

Claim.—"1st, In combination with the pile wire or wires for weaving pile fabrics, a grooved receptacle or trough for holding said pile wire or wires in position whilst being pushed into the shed of the warp. 2d, Pushing said pile wire or wires into the shed of the warps by a driver or pusher. 3d, Guiding and suppporting the pile wires as they are inserted into the shed of the warps by a guide or guides through, over, or on which said wires slide."

3. For an *Improvement in Machinery for Grinding and Polishing Metallic Surfaces, particularly Saw Plates;* Richard M. Hoe, City of New York; patented May 30, 1842; extended seven years from May 30, 1856; re-issued May 5, 1857.

Claim.—"In combination with the rotary and traversing motion of a cylindrical lap or grinding, or polishing surface, the reciprocating motion of the carriage which carries

the plate to be reduced or polished at right angles to the traversing motion of the rotating lap or grinding, or polishing surface, or as the equivalent thereof, a rotary motion. Also, constructing the said grinding, or otherwise reducing or polishing surface of a series of plates of any suitable substance, with spaces between the several plates."

4. For an *Improvement in Hanging Shafts in Mills;* Joseph Bancroft, Executor of Edward Bancroft, dec'd., Philadelphia, Pennsylvania; patented October 9, 1849; re-issued May 12, 1857.

Claim.—"In constructing the boxes for hanging shafting in mills, with circular cavities on the outer surface and on opposite sides, each cavity surrounding a bulb or projection in the form of a segment of a sphere, and having the required thickness of metal outside of such cavities for strength, when such tubes are combined with holding sockets which embrace said bulbs and which are so placed within the said concavities as to allow the boxes thus held to play within the sockets in manner of a universal joint. Also, combining the box which is provided with segments of a sphere on its outer surface, with the hanger pedestal or pillored block, by means of adjustable sockets."

5. For an *Improved Machine for Drying and Pressing Paper;* John North, Middletown, Connecticut; patented April 14, 1857; re-issued May 19, 1857.

Claim.—"1st, The encasing of the cylinders in part, and attaching of brushes inside of said cases, and the application of saw-dust, or other proper substance, for the purpose of cleaning the outer surface of the pressing cylinders. 2d, Combining two or more hollow steam or heated chests at proper distances apart, so as to admit of the sheets of paper to pass between said chests free and unobstructed, by means of endless belts, or their equivalents. 3d, Encasing the outer surface of the heated chests as combined by non-conducting substances, for the purpose of retaining the heat. 4th, In combination with the pressing cylinders, the drying apparatus, consisting of heated chests, between which the sheets of paper are passed on tapes, or their equivalents, without touching or dragging thereon."

6. For an *Improved Cowl or Draft Accelerator for Steamers;* Peter C. Guiou, Cincinnati, Ohio; patented November 4, 1856; re-issued May 26, 1857.

Claim.—"Their combination constructively."

DESIGNS.

1. For *Stoves;* Jacob Steffe, James Horton and John Currie, Assignors to F. H. Church, Philadelphia, Pennsylvania; dated May 5, 1857.
2. For *Cooking Stoves;* Jacob Beesley and Edward J. Delany, Assignors to Cresson, Stuart & Peterson, Philadelphia, Pennsylvania; dated May 19, 1857.
3. For *Stoves;* Russell Wheeler and Stephen A. Bailey, Utica, New York.
4. For *Churns, Egg Beaters, &c.;* John S. Gallagher, Jr., Washington, District of Columbia.
5. For *Picture Frames;* A. P. C. Boute, Cincinnati, Ohio; dated May 26, 1857.
6. For *Furnaces;* Willis S Bronson, Hartford, Connecticut; dated May 26, 1857.
7. For *Stoves;* Garretson Smith, Henry Brown, and Samuel H. Sailor, Assignors to J. G. Abbott and Archiles Lawrence, Philadelphia, Pennsylvania; dated May 26, 1857.

The claims on the above are for the several shapes, forms, and ornaments.

MECHANICS, PHYSICS, AND CHEMISTRY.

*Self-Indicating Balance Barometer.**

M. Secchi, of Rome, has recently invented a new construction of barometer, which possesses the advantages of not being liable to be broken, of giving the readings exact, which Aneroids and others do not, and of recording those readings by self-acting mechanism. M. Secchi says that all improvements hitherto have been limited to the employ-

* From the Lond. Civ. Eng. and Arch. Jour., Feb., 1857.

ment of large tubes to avoid the evils of capillary attraction, and to the obtaining of greater exactitude in the readings. All attempts to make the instrument graphic—that is to say, self-acting to record the different variations, and to make the indications more minute—have not yet been successful. The principles on which the new barometer is constructed will be understood by the following statement:—Suppose the cuvette of a barometer to be placed on a table and the glass tube so arranged as to admit of its being lifted by hand. The force that will be required to lift the tube will be equal to the weight of mercury in the tube, or in other words, to the amount of atmospheric pressure exercised on the mercury of the instrument. We shall therefore be able to really weigh the pressure of the atmosphere by attaching the barometer (the tube only) to one end of a balance, and weights to the other; for it is evident that at every change in atmospheric pressure a corresponding increase or decrease in weight will have to be made at the other end of the balance to maintain equilibrium. To ascertain the value of absolute pressure on a unity of surface, it will be necessary to take into consideration the weight of the tube, and also of the weight of that portion thereof which is immersed in the mercury contained in the cuvette, and especially the internal sectional area. The knowledge of the latter, so far from being an obstacle, is a positive advantage in construction; for, by increasing the sectional area, the force that actuates the instrument will also be increased, and will consequently permit of more exact and more minute readings. If the sectional area be 10 squares centimetres, and the pressure varies by centimetres in height, the weight to be placed at the other end of the balance will be that of 19 cubical centimetres of mercury, or 135 grammes; while, if the sectional area had been equal to one square centimetre only, the weight would have been but 13·5 grammes.

Starting from these observations, M. Secchi adopted the following construction for his barometer, which has been made and used in the observatory at Rome. The barometrical tube is attached to one end of a steelyard or balanced lever, which carries at the other end a counterbalance weight and a pointer, 15 millimetres, or $\frac{5}{8}$-inch diameter, which is reflected in a mirror. This mirror also reflects a graduated scale, so that the variation of $\frac{1}{10}$th of a line of the pointer is indicated by a movement of six lines on the reflected image. The writer enumerates the following advantages peculiar to his invention:—1. As the atmospheric pressure is weighed, and not indicated by the height of the column of mercury, the tube may be constructed of any non-fragile material, such as iron, which does not amalgamate with the mercury, provided the bore is of equal diameter throughout. 2. By increasing the sectional area of the tube, the additional weight will give sufficient motive power to a pencil attached to the other end of the lever to mark the variations of atmospheric pressure. 3. By the intervention of suitable gearing, the scale of observations may be augmented without inconvenience or danger to the exactness of the instrument. 4. The new construction is independent of the form of the miniscus, of the purity of the mercury, of its specific gravity, and of the temperature and difference of gravity peculiar to different latitudes, for all these qualities exercise influence upon the volume of mercury, and on the height of the column of mer-

cury in the tube, which has to be measured to obtain the weight of atmospheric pressure, whereas, with the new instrument, the weight is given at once. Another advantage of employing iron for barometrical tubes is, that there is no danger to fear from the adhesion of air or moisture, and that the mercury may be boiled without fear of bursting. Iron barometrical tubes will likewise permit of other fluids being employed, and probably advantageously, instead of mercury. The writer further states that he invariably found his new barometer indicate variations of atmospheric pressure before ordinary barometers did so, and that by avoiding loss from friction, most exact instruments may be produced. The perusal of the description of this ingenious invention has suggested its application to some practical purposes, which are submitted to the attention of engineering and scientific men.

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*Fire-clay Moulds for Casting Pipes.**

The idea of using fire-clay surfaces, for casting iron pipes and other articles, was first practically developed by Messrs. Hoby and Kinniburgh, at the London Works, Renfrew, some four or five years ago.† Beginning with a solid coating of fire-clay over the whole length of the mould, Mr. Kinniburgh, who worked with great peseverance at his project, found himself gradually driven to the use of sectional portions of fire-clay bricks, and under this form we now find the system in successful operation. Our three illustrations exhibit the details of the whole process as applied for casting pipes. In fig. 1 we have represented the mode of moulding the sectional portions of fire-brick, with which the mould box is lined. All the pattern or original matrix which is necessary, is a short length of iron pipe, accurately turned externally. It is upon this that the fire-clay, with a slight admixture of sand, is moulded into the required sectional forms by means of an open brick mould or wooden frame, which is placed upon the pattern piece, so that the clay kneaded into it, is at once formed to the contour of the pipe, upon its inner or under surface. Our figure shows the dimensions of these sectional portions of fire-brick, which the inventor has found to be conveniently suitable for his purpose. At the earlier stages, of his work, he tried larger sizes, but experiment proved, that the smaller these sections are, consistent with regard to collateral requirements, the more accurate and satisfactory is the mould.

Fig. 1.

Fig. 2 is a sectional elevation of one of the moulds as lined with these bricks; the joints being filled up with a clay mortar, so as to bring the whole to an uniformly even surface, fit for shaping the metal to the required accuracy of form.

Fig. 3 is a section of the moulding pit where the casting takes place, showing the mould box open, with a finished core standing erect in the centre. The two halves of the mould box are hinged upon a bottom

* From the Lond. Prac. Mech. Journal, April, 1857.

† See page 263, Vol. vi., *Practical Mechanic's Journal.*

central stud-pin, over which part the core is set on end, when the two halves of the mould box are brought together, and the mould is ready for casting. Each half of the mould box has jointed to it a toothed rack, passed through a suitable guide on a pedestal, carrying the bearings for a winch spindle, on which is a spur-pinion, gearing with the rack. In this way, a few turns of the winch in either direction opens or closes the mould box. When the metal begins to set in the mould, the core bar, which is of the collapsable kind—also an invention of Mr. Kinniburgh—is slacked off or reduced in diameter, by merely turning the central actuating spindle. The two halves are then opened by their respective rack and pinion actions, and the newly cast pipe is left ready for removal. When the mould has somewhat cooled down, any flaws in its surface are easily repaired with a little clay composition, when the whole surface is blackwashed, so as to be at once ready for another casting.

There are just now at work in the London Works, Renfrew, three moulds of this kind, producing 18-inch pipes for the Blackburn Water Works. The pipes so made are very good specimens of work; the only evident fault about them, being a slight undulation of surface, arising apparently from some expansive distortion of the fire-clay surface. The two usual longitudinal fins are the only ones visible upon the surface of the pipes, which is clean and smooth, and the slight distortion to which we have referred, seems to affect nothing but the eye of the critical examiner, for the work can be in no way injured by it.

Fig. 2.

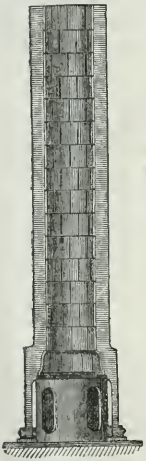
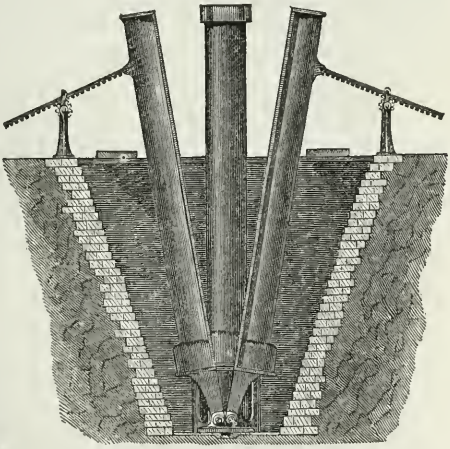


Fig. 3.



In illustration of what can be accomplished with fire-clay moulds, it may be mentioned that, at the present time of writing, upwards of eighty pipes have been cast in one single mould, and the process still goes on

with unfailing results in the shape of good pipes. It is at present impossible to see the end of this new system, but it must be obvious that a system whereby a mould once made, can be made to turn out so many of its counterparts, must be capable of withstanding a gond many counterbalancing disadvantages on other points, even supposing such to exist.

For the Journal of the Franklin Institute.

Notes on the Performance of the Steamer Joseph Whitney, with a Comparison of her Performance with that of the Steamer Wm. Jenkins.

In the May number of this *Journal* will be found a carefully prepared detail of the performance of the steamer "*William Jenkins*," and we now propose to present a statement of the performance of her consort "*Joseph Whitney*," and for that purpose we have been furnished with her steam log, and the accompanying diagrams for a single run to Boston, during which time the attending circumstances of wind and sea, as well as the displacement of the ship, &c., were so similar to those attending the trips of the "*William Jenkins*," (the log which furnished the data for that investigation,) as to present a peculiarly favorable opportunity to arrive at a correct conclusion as to their relative efficiency.

In the present investigation, the effective pressure on the piston and the evaporation of the boiler, are both calculated from averages taken from diagrams Nos. 1, 2, and 3. The losses from oblique action of the wheels, are calculated in the usual way, viz: by taking the mean of the squares of the sines of the angles of incidence, at which the paddles strike the water. The following is the engineer's log for the run:

STEAM LOG—*Of Steamer Joseph Whitney, bound to Boston, March 28th*, 1857.

Date, &c., Mar. 28, 1857.	Average steam.	Cut-off per Card.	Vacuum.	Throttle valve.	Register.	Revolutions per hour.	Average revolutions per minute	Sounding.	Hot-well.	Average coal per hour.
M. 12 P. M.	19	42	28½	Full.	474148		8·8		110°	1208·5
1	19	42	28½	Full.		529·2	8·8		110°	1208·5
2	"	"	"	"		"	"		"	"
3	"	"	"	"		"	"		"	"
4	"	"	"	"	476265	"	"		"	"
5	"	"	"	"		610·2	"		"	"
6	"	"	"	"		"	"		"	"
7	"	"	"	"		"	"		"	"
8	"	"	"	"	478706	"	"		"	"
9	"	"	"	"		600	"		"	"
10	"	"	"	"		"	"		"	"
11	"	"	"	"		"	"		"	"
12	"	"	"	"	481107	"	"		"	"
Av'ge.,	19	42	28½	Full.			8·8		110°	1208·5

Remarks.—28th March, ship's draft, forward 12 feet 8 inches, aft 13 feet 9 ins., dip of wheel 7 feet 8 ins.

At 12h. 26′, P. M., left the dock at Baltimore, weather pleasant.

STEAM LOG—*Of Joseph Whitney, bound to Boston, March 29th, 1857.*

Date, &c., March 29, 1857.	Average Steam.	Cut-off, per Card.	Vacuum.	Throttle valve.	Register.	Revolutions per hour.	Average Revolutions per minute.	Saturation	Hot-well.	Average coal per hour.
A. M.										
1	19	42	28½	Full.		592	9 8	1¾	110°	1208·5
2	"	"	"	"		"	"	"	"	"
3	"	"	"	"		"	"	"	"	"
4	"	"	"	"	483475	"	"	"	"	"
5	"	"	"	"		614	10·2	"	"	"
6	"	"	"	"		"	"	"	"	"
7	"	"	"	"		"	"	"	"	"
8	18	"	"	"	485930	"	"	"	"	"
9	"	"	"	"		593	9·8	"	"	"
10	"	"	"	"		"	"	"	"	"
11	"	"	"	"		"	"	"	"	"
12	"	"	"	"	488315	"	"	"	"	"
P. M.										
1	"	"	"	"		606	10·1	"	"	"
2	"	"	"	"		"	"	"	"	"
3	"	"	"	"		"	"	"	"	"
4	19	"	"	"	490740	"	"	"	"	"
5	"	"	"	"		"	"	"	"	"
6	"	"	"	"		"	"	"	"	"
7	"	"	"	"		"	"	"	"	"
8	"	"	"	"	493173	"	"	"	"	"
9	"	"	"	"		607	10·2	"	"	"
10	"	"	"	"		"	"	"	"	"
11	"	"	"	"		"	"	"	"	"
12	"	"	"	"	495617	"	"	"	"	"
Avg'e.	18·66	42	28½	Full.		10·3	1·75	110°	1208·5	

Remarks.—March 29th. This day commences pleasant and calm, with a smooth sea. At 5h. 56′, A. M., passed out by Cape Henry. Register 484,660. At 2h. P. M., abreast of "Chincotique," latter part of this 24 hours light airs from W. N. W., fore and aft sails set.

STEAM LOG—*Of Joseph Whitney, bound to Boston, March 30th.*

Date, &c., March 30, 1857.	Average Steam.	Cut-off, per card.	Vacuum.	Throttle valve.	Register.	Revolutions per hour.	Average revolutions per minute.	Saturation	Hot-well.	Average coal per hour.
A. M.										
1	19	42	28½	Full.		570·7	9·5	1¾	110°	1208·5
2	"	"	"	"		"	"	"	"	"
3	"	"	"	"		"	"	"	"	"
4	"	"	"	"	497900	"	"	"	"	"
5	"	"	"	"		584	9·7	"	"	"
6	"	"	"	"		"	"	"	"	"
7	"	"	"	"		"	"	"	"	"
8	"	"	"	"	500235	"	"	"	"	"
9	"	"	"	"		614	10·2	"	"	"
10	"	"	"	"		"	"	"	"	"
11	"	"	"	"		"	"	"	"	"
12	"	"	"	"	502690	"	"	"	"	"
P. M										
1	"	"	"	"		619	10·3	"	"	"
2	"	"	"	"		"	"	"	"	"
3	"	"	"	"		"	"	"	"	"
4	"	"	"	"	505165	"	"	"	"	"
5	"	"	"	"		627	10·4	"	"	"
6	"	"	"	"		"	"	"	"	"
7	"	"	"	"		"	"	"	"	"
8	"	"	"	"	507675	"	"	"	"	"
9	"	"	"	"		630	10·5	"	"	"
10	"	"	"	"		"	"	"	"	"
11	"	"	"	"		"	"	"	"	"
12	"	"	"	"	510195	"	"	"	"	"
Avg'e.	19	42	28½	Full.		10·1	1·75	110°	1208·5	

Remarks.—March 30th. This day commences pleasant with a smooth sea, and high easterly winds. At 1 h. 47′, A. M., Gay head abeam. Register 507,874; latter part of this 24 hours wind variable.

STEAM LOG—*Of Joseph Whitney, bound to Boston, March* 31, 1857.

Date, &c., Mar. 31, 1857.	Average steam.	Cut-off, per Card.	Vacuum.	Throttle valve.	Register.	Revolutions per hour.	Average revolutions per minute.	Saturation.	Hot-well.	Average coal per hour.
A. M.										
1	19	42	28½	Full.		626	10·4	1¾	110°	1208 5
2	"	"	"	"		"	"	"	"	"
3	"	"	"	"		"	"	"	"	"
4	"	"	"	"	512700	"	"	"	"	"
5	"	"	"	"		631	10·5	"	"	"
6	"	"	"	"		"	"	"	"	"
7	"	"	"	"		"	"	"	"	"
8	"	"	"	"	515225	"	"	"	"	"
9	"	"	"	"		624	10·4	"	"	"
10	"	"	"	"		"	"	"	"	"
11	"	"	"	"		"	"	"	"	"
12	"	"	"	"	517721	"	"	"	"	"
P. M.										
1	"	"	"	"		631	10·5	"	"	"
2	"	"	"	"		"	"	"	"	"
3	"	"	"	"		"	"	"	"	"
4	"	"	"	"	520245	"	"	"	"	"
5										
Av'ge.,	17	42	28½	Full.			10·45	1·75	110°	1208·5

Remarks.—March 31st. This day commences and ends pleasant; light airs and smooth sea. At 4h. 43′ P. M., come to at the dock at Boston, running time 76 hours 17 minutes. Total number of revolutions made 46,536, and consumed 41 tons of coal. The following diagrams are placed in the order in which they were taken, and show the average performance for the run. Draft of ship on arriving at Boston, aft 13 feet 3 inches, forward 12 feet 3 inches.

From the foregoing log, the following summary of averages were taken :—

Average coal per hour,	1208·5 lbs.
" Steam per gauge,	18·915
" Cut-off (per cards),	42 inches.
" Revolutions per minute,	9·845
" Vacuum per gauge,	28½
" Temperature of hot-well,	110°
" Density of boiler water,	1¾

BOILER—One upper return flue.

Length,	28 feet.
Breadth,	14 ft. 9 ins.
Height exclusive of chimney,	10 ft. 2 ins.
Length of grate bars,	7 ft. 3 ins.
Diameter of smoke pipe,	55 ins.
Height of "	35 feet.
Total heating surface,	2303 sq. ft.
Total grate surface,	96 "
Fuel,	Bituminous coal.
Natural draft,	

Coal consumed per hour per square foot of grate surface 12·4 lbs.

With the above consumption of coal, and using 167·9 cubic feet of steam per stroke, (including space between valves, capacity of nozzles, and piston clearance), of the terminal pressure as taken from the diagrams, we have the evaporating efficiency of the boiler in its normal working condition (neglecting the losses arising from leakage and radiation,) as follows:—

$\frac{167 \cdot 9 \times 20 \cdot 4}{1932} = 1 \cdot 77$, and $\frac{1 \cdot 77 \times 60 \times 64 \cdot 3}{1208 \cdot 5} = 5 \cdot 65$ pounds of water evaporated to the pound of coal.

Loss from Blowing.—In order to maintain the water in the boiler at a density of $1\frac{3}{4} \div 32$, that is, $1\frac{3}{4}$ pounds of salt to 32 pounds of water, a loss is sustained as follows:—

$$\frac{1202 - 110^{\circ} \times \cdot 75}{115^{\circ}} = \frac{1 \cdot 00}{7 \cdot 08} = 14 \cdot 1 \text{ per cent.}$$

The water thus blown out having been heated at an expense of 14·1 per cent. of the total amount of fuel consumed, and as we have seen that one pound of coal evaporated 5·6 pounds of water exclusive of radiation, &c., &c., it remains but to ascertain what amount of water should be evaporated by the 14·1 per cent. of lost fuel, in order to arrive at the true efficiency of the boiler, which is as follows: 100 : 5 65 : : 14·1 : ·769 and ·769 + 5·65 = 6·44 *pounds of water evaporated to the pound of coal as the total working effect of the boiler.*

The loss of power by filling the space between valves, nozzles, and clearance of piston, before the commencement of a revolution equals 5·1 horse power.

Performance of Engine.—The mean performance for the run of 76 h. 17 min., was as follows: $\frac{2123 \cdot 7 \times 21 \cdot 66 \times 224 \cdot 4}{33{,}000} = 312 \cdot 79$ the total developed horse power distributed as follows:—

Friction of engine,	5·00	per cent.	or	15·63	Horse Power.
" load,	4·50	"	"	14·07	"
To work air-pump,	4·60	"	"	14·34	"
Oblique action and slip,	23 78	"	"	74·66	"
Leaving to be utilized in propelling the ship,	62·12	"	"	194·09	"
	100·00	"	"	312·79	"

Coal consumed per hour per effective horse power 6·2 lbs.
Proportion of immersed sectional area to effective horse power 2 to 1.
Coal per mile, allowing the total distance to be 666, 137·9 pounds.

Having sufficient data for a comparison, we propose briefly to recapitulate a few of the conclusions arrived at, and place them in a convenient form for reference, from which it will be seen that of the two ships under consideration, the "*J. Whitney*," is the more economical vessel of the two, and such, I understand, is the fact in practice.

The difference, however, existing in their performance, must, we think, be attributed in part, if not entirely, to the superior model of the *Whitney*, as will appear from an examination of the following summary.

WILLIAM JENKINS.

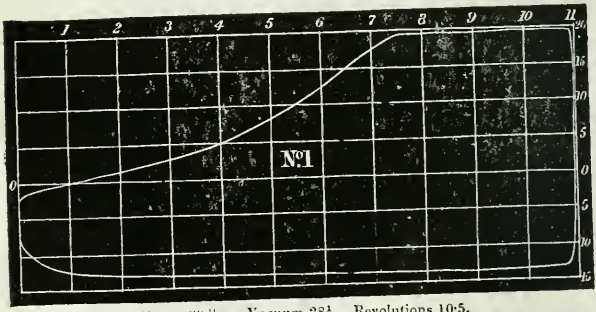
Total per cent. of power developed,	100 or 458·439 H. P.
" friction of engines, &c.,	41·1 or 188·442 "
" utilized in propelling Ship,	58·9 or 269·997 "
	100·0

JOSEPH WHITNEY.

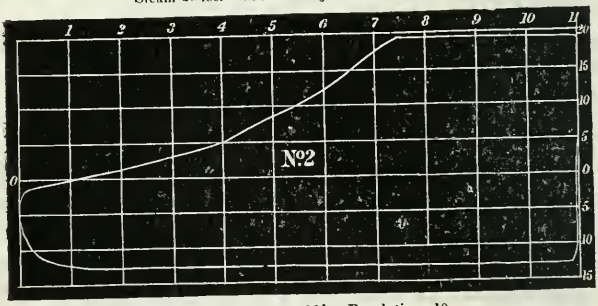
Total per cent. of power developed,	100 or 312·79 H. P.
" absorbed in friction, &c.,	37·88 or 118·48 "
" utilized in propelling ship,	62·12 or 194·31 "
	100·00

From the above it will be seen that the power utilized in propelling the "*William Jenkins*," exceeds that of the "*Whitney*" 28 per cent., while the latter, under the same circumstances of weather, &c., makes the quickest runs.

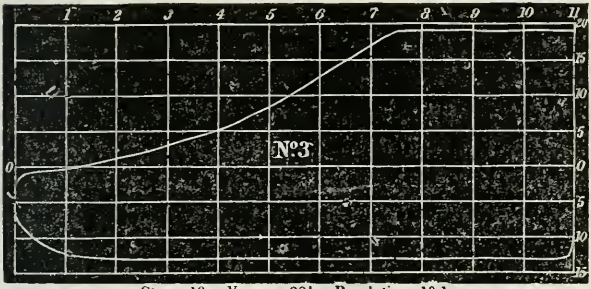
Scale 1-20=1 pound.



Steam 20 lbs. Vacuum 28¼. Revolutions 10·5.



Steam 19½. Vacuum 28¼. Revolutions 10.



Steam 19. Vacuum 28½. Revolutions 10·1.

Boilers.—Assuming the number of pounds of water evaporated in a boiler per pound of coal, to be the measure of its practical efficiency, we have as follows:—"*William Jenkins*'" boiler evaporates 8·79 lbs. of water to the pound of coal. The "*Whitney*" evaporated 6·44 lbs. of water to the pound of coal, showing the boiler of the former produces 26 per cent. better results than the latter.

J. Whitney.—Proportion of the immersed sectional area to effective horse power, 2 to 1.

Coal consumed per mile 137·9.

Coal consumed per hour per effective horse power 6·2 lbs.

William Jenkins.—Proportion of immersed sectional area to effective horse power, 1·4 to 1.

Coal consumed per mile 149·4.

Coal consumed per hour per effective horse power 6·1 lbs.

Specification of a Patent granted to Charles William Siemens *and* Joseph Adamson, *of Leeds, for Improvements in Rotary Fluid Metres.* [Dated 24th March, 1853.]*

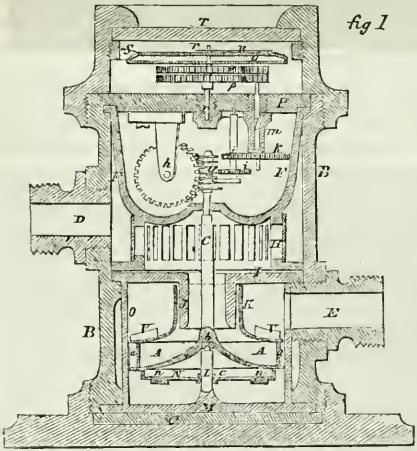
This invention relates principally to metres for measuring water, but it may also be employed for metres for measuring other fluids. In the following description certain materials are mentioned which are applicable to metres for measuring water and similar non-corrosive fluids.

In fig. 1, is a vertical section of one of the improved fluid metres, and fig. 2, is a plan view of the drum of the same. A, is the hollow drum having two tangential apertures *a*, *a*. The water or other fluid is introduced into the centre of this drum, and allowed to escape at the apertures *a*, *a*, and in its passage it causes the drum to revolve in the direction of the arrow, (see fig. 2.) The revolutions of the drum are registered by a counter at the upper part of the metre, which indicates the quantity of fluid passed through the metre.

B, is the outer cylindrical casing of cast iron screwed to the base-plate

* From Newton's Lond. Journal, January, 1857.

C; D, is the inlet opening for the entrance of the fluid, and E, is the outlet; F, is a circular chamber of white metal, such as pewter, with a bush of German silver in the centre, forming a bearing for the spindle G, of the drum A. H, is a cylindrical perforated ring or cage cast in one piece with the chamber F, and surrounded with wire gauze for the purpose of preventing the entrance of any solid matters which might choke the passages or obstruct the motion of the drum; I, is a flat disk or partition, with a cylindrical neck or pipe J, which enters the neck K, of the drum A. The top and bottom of the drum are curved, so that the fluid may flow in with as little obstruction as possible. A small flat piece of steel or agate *b*, is fixed to the lower end of the spindle G, and rests



upon a round pointed piece of steel or agate at the top of the cylindrical stem L, which rises from the centre of the disk M. N, is a circular plate with the edges turned up and fixed to the drum A, so as to form a chamber, which is to be filled with oil when the metre is employed for measuring water; *n*, *n*, are apertures, with screw plugs, for the introduction of the oil. A bush *c*, is fixed in the centre of the plate N, to serve as a guide for the drum, and to prevent the escape of the oil. O, is a cylindrical lining, or inner case, forming a chamber in which the drum A, revolves; V, V, are small flat vanes or drag boards fixed on the drum A, for the purpose of somewhat retarding its motion. These vanes are of considerable importance, as without them the drum would make a greater number of revolutions, when a certain quantity of fluid is passed rapidly through it, than it would when the same quantity of fluid is passed slowly through it. The vanes V, experience a greater degree of resistance as the velocity increases, and thus serve to equalize the indications of the metre.

The spindle G, carries a screw *g*, at its upper end, which drives the worm-wheel *h*, on the axis of which is another screw for driving a worm-wheel *i*, on whose axis is a pinion *j*, driving the wheel *k*. The speed is thus reduced, so that the spindle *l*, of the wheel *k*, only makes one revolution for several hundred revolutions of the drum A. The spindle *l*, passes through a short tube or socket *m*, fixed to the plate P, and carries at its upper end a pinion *o*, which gears into the two wheels *p*, *q*, one of which, *p*, has one hundred and one teeth, while the other, *q*, has one hundred teeth. The upper one, *p*, is fixed to a short tube which carries the dial Q, while the lower wheel *q*, is fixed to the spindle, *r*, which carries the index R. Another index S, is fixed to the casing. The dial Q, is divided into one hundred parts, which are numbered in one direction on the outside, and in the opposite direction on the inside. The fixed index S, points to the units, while the movable index R, points to the hundreds. The units may be gallons, or hundreds, or thousands of gallons, or cubic feet, or other integer. The dial is protected by a strong glass plate T.

The spindle *l*, has a conical shoulder, which is pressed up to the end of the socket *m*, by the pressure of the fluid, which is thus prevented from escaping.

The chamber F, is filled with oil so as to keep the wheel-work lubricated, and prevent the entrance of the fluid which is being measured. The drum A, may be made with three, four, or more apertures, in lieu of the two apertures *a*, *a*. Or, in lieu of a drum, two or more hollow arms or spokes, with tangential apertures at the ends, may be employed.

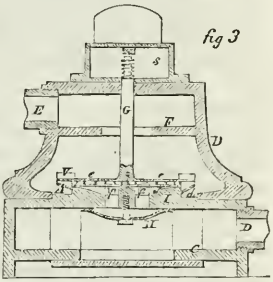


Fig. 3, is a vertical section of another form of the improved fluid metres. Fig. 4, is a plan view of the wheel which measures the fluid, and of the channels or guide curves which conduct the fluid to it.

A, is a wheel mounted on a spindle G, and consisting of a flat disk *a*, and a conical ring *d*, with a number of straight or curved blades *e*, *e*, between them. The spindle G, turns upon a pin *b*, at the lower end, and upon another pin *s*, at the upper end. Within this wheel is a circular block I, and a disk J, between which are several blades *f*, *f*, curved or inclined in the opposite direction to the blades *e*, *e*. B, is the casing which is fixed upon the hollow base C, C. D, is the inlet, and E, is the outlet. H, is a perforated plate or strainer to prevent solid matters from entering the wheel. There is an opening in the bottom of the base for the removal of any solid matters, which opening is closed by a plate. F, is a partition in the upper part of the casing, with a circular aperture in the centre. The water or other fluid enters the base C, by the inlet D, and ascending through the perforated plate H, passes between the guide-blades *f*, *f*, and impinges upon the blades *e*, *e*, of the wheel A, and causes it to revolve. The fluid ascends through the aperture in the partition

F, and escapes at the outlet E. The partition F, serves to prevent the establishment of unequal currents from different parts of the wheel to the outlet. The number of revolutions of the wheel A, is registered by means of wheel-work, and a dial or dials, as in the metre, shown in fig. 1, or as employed in gas metres or other apparatus in which counters are used. Small vanes V, V, are fixed on the top of the wheel A, for the purpose of somewhat retarding its motion, as in the metre shown in fig. 1.

The patentees show a modification of this metre, in which the inner set of blades is made to revolve. This arrangement has an internal movable wheel, consisting of a disk and blades as before, with the addition of another circular plate with a neck. The inner wheel revolves round a fixed pin, on the top of which the outer wheel revolves. The remainder of the metre is similar to that shown in fig. 3. The wheels will revolve in opposite directions when the fluid passes through them, and they may either be allowed to revolve independently of each other, or they may be geared together so as both to act upon the counter. The metre may also be arranged so that the fluid may enter at E, and escape at D; and the motions of the wheels will then be reversed, and the graduations on the dial or dials must be made to correspond. The outer wheel may also be fixed, and only the inner one allowed to revolve; its revolutions being registered by connecting the counter to it.

In all these arrangements of metres, the apparatus is enclosed in a case with an inlet and outlet opening, so that the metre may be employed for measuring fluids under pressure. Thus, if one of the improved metres be employed for measuring the water supplied to a dwelling or a factory, the metre may be placed on the ground floor or other convenient position, and the outlet pipe from it may be carried up to the top of the building, or wherever the water is required. This would not be the case if the measuring wheel were not inclosed in a case, and the water merely dropped from it into a cistern. The omission of the case would also render the indications of the metre less accurate under varying pressures of fluid, and would also increase the friction.

Another form of the improved metre for measuring fluids, adopted by the patentees, consists of a paddle-wheel, with straight or curved blades revolving in the air-tight case provided with inlet and outlet passages. The upper part of the case is filled with compressed air or other suitable gas, which prevents the liquid from rising into it. The liquid thus flows through the lower part of the case, and carries round the paddle-wheel with it. The revolutions of the paddle-wheel are registered by a counter, as in the other metres hereinbefore described.

By simply inverting this apparatus it may be employed to measure fluids lighter than that contained in the chamber, provided they do not mingle together. Thus by filling the chamber with water, it may be employed for measuring air,—and by filling the chamber with mercury, it may be employed for measuring water.

The invention relates also to improvements in certain varieties of fluid metres constructed with screw drums, and described in the specification of a patent granted to Mr. Siemens, 15th April, 1852.

In some of the modifications of this metre two screw drums are em-

ployed, the first of which is allowed to revolve freely, while the second drum is connected to the counter. As an improvement, the patentees apply the vanes or drag-boards to the first screw drum, so as to retard it somewhat, and cause the fluid to impinge with greater effect upon the second or registering drum.

Screw metres may be constructed in which the first screw is fixed; and the second or registering screw drum is provided with the vanes or drag-boards, to produce a greater resistance at high velocities than at low velocities.

This metre may be modified so as to relieve the spindle of the screw drum from end pressure, by employing a long drum having a right-handed screw upon one end, and a left-handed screw upon the other end, with the vanes or drag-boards in the centre of the intermediate space. The fluid is then admitted through left-handed and right-handed screws fixed at opposite ends of the case of the metre, and is conveyed away from the centre of the case.

The patentees claim, "Firstly,—the construction and arrangement of rotary fluid metres, with a revolving wheel or wheels connected with a counter and inclosed in a case, and so arranged that the fluid to be measured flows from the centre towards the circumference, or from the circumference towards the centre of the wheel or wheels, in manner hereinbefore described in reference to figs. 1, 2, 3, and 4. Secondly,—the construction of fluid metres with a paddle-wheel connected with a counter, and revolving in a chamber containing another fluid, which is not miscible with the fluid to be measured, as hereinbefore described. Thirdly,—the application to rotary fluid metres of vanes or drag-boards, in manner hereinbefore described."

Specification of a Patent granted to Edward Aldridge, *of Boston, Lincolnshire, for improvements in metres for measuring the flow of liquids and fluids, which can also be employed for obtaining motive power, and in taps for regulating the flow of liquids.*—[Dated 25th May, 1855.]*

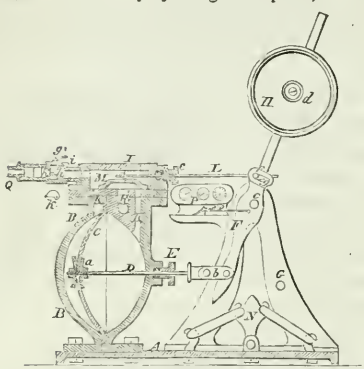
This invention of improvements in water metres consists in the employment of a flexible diaphragm fitted inside a spherical or other suitably shaped vessel, into which water, gas, or other liquid or fluid is alternately admitted or expelled through a slide, similar to the slide-valve of a steam engine, and which is worked by a rod passing through a stuffing-box at one side of the vessel and connected to the flexible diaphragm. The quantity of liquid or fluid passing through the vessel may be registered by any suitable registering arrangement, worked by the rod which sets the slide in motion.

The improvement in taps for regulating the flow of liquids into or from such metres as aforesaid, and for regulating the flow of liquids generally, consists in casting upon a shaft, or otherwise fitting thereon or thereto, a cam or eccentric, which bears upon the spindle of a valve which is kept in its seat and closed by a pressure of liquid upon it. On turning the shaft, the rise of the cam forces back the spindle and valve,

* From Newton's Lond. Journ., January, 1857.

and opens a small or wide passage for the liquid, according to the swell of the cam and the amount of turn given to the shaft.

The cut represents a sectional elevation of the improved metre. A, A, is a cast iron bed or base-plate, for supporting the working parts of the metre or engine, when this apparatus is used as such. B, B, is a metal spheroidal vessel, formed in two parts or halves, bolted together; C, is a flexible diaphragm, the edge of which is inserted between the halves of the vessel B, and the whole bolted together; D, is a rod fixed to the diaphragm C, by means of two plates *a*, *a*, tapped and screwed on each side of the diaphragm. This rod works through a stuffing-box E, in the side of the vessel, and is connected by the links *b*, to the lever F, centred on a projecting stud-pin *c*, fixed in a standard or bracket G, bolted to the base-plate A. At the top of the lever F, is fixed a balance weight H, having a set-screw *d*, passing through it to the lever, by means of which the balance weight can be set at any required position upon the lever, according to the pressure of the liquids. I, is a valve-box, fitted on the top of the vessel B; and K, K, are passages which alternately form the in-flow, and outlet for the liquid or fluid; L, is the valve-rod which passes through the stuffing-box *e*, and is connected at one end to the slide-valve M, and at the opposite end to the lever F, by means of a cross-head *f*, working in slots *g*, in a forked part of the lever F, as shown,—so that the lever may have a greater stroke than the valve-rod L. N, is a short lever, working upon a joint fixed to the base-plate A, and fitted with two flexible springs of vulcanized india-rubber or other material. This lever and springs are to prevent the lever F, from falling over directly it has passed the vertical line, and serve, in combination with the slots *g*, to keep the valve open until the vessel B, is filled with the liquid or fluid; after which the lever F, is liberated from the lever N, and the sudden jerk caused by the falling of the lever F, and balance weight, gives to the cross-head *f*, a blow sufficient to reverse the slide, and allow the water or other liquid or fluid in the vessel to flow out, and a fresh charge to flow in. O, is a rod fixed in a stud-pin in the lever F, and is for the purpose of giving motion to the registering apparatus P; Q, is the inlet pipe to the vessel B, which is fitted with the improved regulating tap; *g*, is a spindle or shaft, having a cam or eccentric *h*, (see the detached view) cast upon it, or otherwise fitted thereto. The spindle *g*, works in a step in the body of the tap, and the top part passes through the screwed cap *i*. *k*, is a spindle-valve, which is fitted into its seat with the back part towards the pres-



sure, the spindle of the valve working up against the lower side of the cam. On turning the spindle *g*, the rise on the cam forces back the valve, and thereby admits the inflow of the water. When the cam ceases to act against the spindle of the valve, the pressure of the liquid or fluid serves to keep the valve close in its seat. R, is the out-flow pipe, fitted with a similar valve and cam to those just before described. To employ this metre as a motive power engine, the rod D, passing through the side of the vessel containing the diaphragm, has to be connected to the machinery to be worked. An engine may have two rods working in the same line connected to the diaphragm, one passing through one side and the other through the opposite side of the vessel.

The patentee's claims are, "First,—the improved arrangement and construction of metres for measuring the flow of liquids and fluids, as hereinbefore described and represented in the drawings hereunto annexed. Second,—I claim the adaptation to and employment of my improved metre, represented in the drawings hereunto annexed, as a motive power engine, arranged and modified in manner hereinbefore described. And, third,—I claim the improved construction of tap or valve for regulating the flow of liquids or fluids, as hereinbefore described and represented in the drawings hereunto annexed."

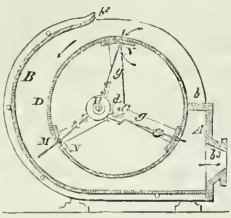
Specification of a Patent granted to AUGUSTA EDOUARD LORADOUX BELLFORD, *of Strand, for certain improvements in rotary blowing machines; which are also applicable to rotary pumps, to rotary engines to be driven by steam or other fluids, and to metres for measuring the flow of fluid bodies,—being a communication.*—[Dated 26th June, 1855.]*

This invention relates, firstly, to the method of operating the fans, buckets, or sliding pistons, as they may be variously termed, according as they belong to a blowing machine, a pump, or an engine; and consists in the employment of a drum arranged so that it may be rotated upon its axis, and having slots or openings through its periphery for the fans, buckets, or sliding pistons, in combination with the arrangement of the fans, buckets, or pistons upon an independent axis inside the drum, but eccentric to the axis thereof; so that as the drum is revolved, the fans, buckets, or sliding pistons are projected beyond the surface of the periphery of the drum at one side to fill the case surrounding it, and at the other side are drawn within the periphery of the drum. Secondly, to the use of a roller packing for the aforesaid fans, buckets, or pistons, at the point where they pass through the slots in the periphery of the drum.

The sectional figure illustrates the invention as applied to a blowing machine. A, is the frame, supporting two fixed axles C, C, which form the axis of the drum; B, is the shell or case of the blowing machine. At the top of this case is an open space b^2, for the ingress of air, and at the lower and front side of it a discharge opening b^3, at which the blast is given out to be conveyed to the furnace or other place where required. Between these openings there is an abutment *b*, forming part

* From Newton's Lond Journ., Jan., 1857.

of the case, extending inwards to the periphery of the drum, and separating the induction opening b^2, from the eduction opening b^3. The drum D, fits to work easily and without friction in circular openings in the ends of the case B, and is hollow and open at the ends, having a hub at each end, connected to its periphery by arms *g*, *g*. The hubs are bored to fit as boxes to the fixed axles C, C, on which the drum is to be rotated by power applied in any suitable way to its axis. In the periphery of this drum are cut three longitudinal slots F, F, F, to allow the fans G, G, G, of the blower, arranged within the drum, to pass through them, and as the drum rotates on its axis, to carry with it the said fans, which are arranged on a fixed axle H, eccentric to the axis of the drum, and consequently to project them at one side beyond the periphery, and at the opposite side draw them within the periphery of the drum; so as to carry around the back of the blowing machine a full blast of air, and discharge it at the front side free from any serious back action. Connected to the fixed axle H, are arms *d*, *d*, to which the axles C, C, are attached. The fans to the axle H, are attached to boxes which are fitted to turn freely on the said axle. The fans are packed in the slots F, F, where they pass through the drum, each by a cylindrical piece of metal M, having a longitudinal slot, through which the fan passes, and being secured in a box N, on the inner side of the periphery of the drum. As the fans are consequently changing their angle with the periphery of the drum as the drum rotates, these cylindrical packing pieces M, have a rolling motion in their boxes N.



The construction and operation of a blowing machine having been described, the application of the invention to pumps, rotary engines, and fluid metres, will be easily seen. For any of these purposes the construction of a machine may be in all respects like the blowing machine above described, except that in place of the wide opening b^2, there will be simply a pipe for the induction of water, steam, or other fluid. The operation of a pump will be substantially like that of the blowing machine, but in an engine or fluid metre will be precisely the reverse, the incoming steam or fluid acting upon the fans (which would then, more properly speaking, be sliding pistons), and thereby giving motion to the drum D, and the shaft C.

The patentee claims,—"First, the arrangement of the fans, buckets, or sliding pistons G, G, G, upon an axis H, arranged within a drum D, and eccentric to the axis C, of the said drum; whereby the said fans, buckets, or sliding pistons may be revolved by the said drum, or may be acted upon by steam or other fluid to revolve the said drum, and by the said revolution may be projected beyond the periphery of the drum at one side to fill the casing by which the drum is surrounded, and at the other side may be drawn within the periphery of the drum, substantially as and for the purpose hereinbefore set forth. Second,—the cylindrical adjustable packing M, applied substantially as herein set forth, in combination with the fans, buckets, or sliding pistons G, and the drum D."

*On Soluble Glass, its Preparation and Applications.**

By. J. N. von Fuchs.

In the introduction to this memoir the author refers to the length of time that his discovery, which was made in 1825, remained unnoticed, being at first declared of no consequence, and even attacked. Before his departure from the world, as the celebrated author says, he feels himself impelled, now that the importance of this discovery has been recognised, to publish another series of observations in this memoir. In the first section the author describes the mode of preparation of the four different kinds of soluble glass, the nature and employment of which were treated of by him in his previous papers. These are :—

1. *Soluble Potash Glass.*—This is prepared with—

15	parts of	powdered quartz or pure quartz-sand,
10	"	well-purified potashes,
1	"	powdered charcoal.

On a large scale we may take

45	pounds of	quartz,
30	"	potashes,
3	"	charcoal powder.

These ingredients are well mixed and fused for five or six hours in a fire-proof glass crucible with a strong fire, until the whole has reached a uniform and quiet fluid state, for which purpose no lower temperature is required than that for the fusion of ordinary glass. The fused mass is then taken out with iron ladles, and the crucible again filled with a new charge.

The glass thus obtained is pulverized, and gradually put into about five parts of boiling water in an iron kettle; it is constantly stirred, and fresh hot water is frequently added to replace that which evaporates, and the whole is kept uninterruptedly boiling until it is dissolved, with the exception of a muddy deposit, and a tough film capable of being drawn out into threads is formed upon the surface ; (this takes from three to four hours.) This film indicates that the solution is approaching concentration ; it disappears again, however, when it is immersed, after which the boiling is continued for a short time, in order to bring the solution to the proper state of concentration, in which it has a specific gravity of 1·24 to 1·25. At this strength it is still tolerably fluid, and capable of being employed at once in many cases ; for certain purposes, however, it must be diluted with more or less water. It may also be evaporated further until it reaches the consistence of a syrup, but it can then only be employed with advantage in particular cases.

When, as is not unfrequently the case, it contains some sulphuret of potassium, some oxide of copper, or copper scale is added towards the end of the boiling, in order to destroy it; by this means a small portion of potash is set free ; but this is not only not injurious for most technical purposes, but is even advantageous in many. But if it be desired to have a soluble glass completely saturated with silica, it must be boiled with freshly-precipitated silica until no more of this is dissolved.

* From the Lond. Chem. Gaz., No. 347.

To facilitate its transport, it may be evaporated with constant stirring until it forms a soft mass; and the best vessels for packing it are made of tinned iron. A better and more ready means of preparing it in the solid state is furnished by alcohol. Thus, if the concentrated solution be mixed with one-quarter volume of rectified alcohol, a gelatinous precipitate is produced; this in the course of a day or two contracts strongly, and adheres firmly to the bottom of the vessel. If the supernatant fluid, which not unfrequently contains besides some carbonate of potash, traces of chlorides of potassium and sodium and sulphuret of potassium, be poured away, and the precipitate washed with water and slightly pressed, the soluble glass is obtained in a solid state, very pure, and completely saturated with silica. It is readily and perfectly soluble in water. When the expression soluble glass alone is used in the following pages, the potash glass is always to be understood.

2. *Soluble Soda Glass* is prepared from

45	pounds of	quartz,
23	"	anhydrous carbonate of soda,
3	"	charcoal powder.

This mixture is somewhat more readily fusible than the potash-glass. It may be most cheaply prepared, however, as Professor Buchner has ascertained, by means of Glauber's salts, for which purpose take

100	parts of	quartz,
60	"	anhydrous sulphate of soda,
15–20	"	charcoal.

The product, when completely saturated with silica, furnishes with water a somewhat more opalescent solution than that prepared with potash at the same degree of concentration.

It is not precipitated completely at once by rectified alcohol, like the potash-glass, but only converted into a gelatinous mass; when it is not completely saturated with silica and somewhat diluted, it either gives no precipitate, or only furnishes one after some time, by which it may be easily recognised and distinguished from the potash-glass.

3. *Double Soluble Glass.*—Potash and soda-glass may be mixed together in all proportions, but we can only regard as a normal double glass that which contains equal equivalents of potash and soda, and which may be obtained with certainty with Rochelle salt and the requisite quantity of quartz (100 parts of quartz to 121 parts of Rochelle salt). But this is too expensive for technical purposes, and it may be prepared much more cheaply with equal equivalents of nitrates of potash and soda, or purified tartrate of potash and nitrate of soda, and the corresponding quantity of quartz; this is of sufficiently good quality for technical purposes. It may also be prepared by the direct fusion of quartz, carbonate of potash, and carbonate of soda, according to the following recipe:—

100	parts of	quartz,
28	"	purified potashes,
22	"	neutral anhydrous carbonate of soda,
6	"	charcoal powder.

It fuses perceptibly with greater ease than either of the preceding.

As it is of no consequence for technical purposes to have an exact quantitative proportion, it will not be far wrong to mix 2 parts by measure of concentrated soda-glass with 3 parts by measure of potash-glass; this will give a double glass which is applicable to all technical purposes, for which it is found to be particularly adapted.

4. *Soluble Glass for Fixing.*—The ordinary soluble glass is not adapted to stereochromic purposes; the figures which are fixed by it acquire spots. Soluble glass for this purpose is prepared by fusing together 3 parts of pure anhydrous carbonate of soda with 2 parts of powdered quartz. Of this a concentrated solution is made in water, and 1 part by measure of this is mixed with 4 to 5 parts by measure of concentrated potash-glass completely saturated with silica, by which means, besides an increase of silica, it acquires a larger amount of alkali which is sufficient to prevent its rapid decomposition, without perceptibly altering its other properties. The soluble glass which was previously turbid or opalescent, becomes perfectly limpid and rather more fluid by this means. The use of this mixture is not limited to stereochromy, but it may also be applied with advantage to many other purposes.

Properties of Soluble Glass, and its behaviour to other Bodies.—The solid, or fused soluble glass, which, when pure, has the appearance of ordinary glass, dissolves gradually in boiling water, without leaving a residue; in cold water, however, the solution takes place so slowly, that it might almost be supposed to be quite insoluble therein. It is, however, quite insoluble only when a much larger quantity of silica is combined with it, or a part of its potash is extracted from it, or when other bodies, such as earths, metallic oxides, &c., are present in it, which combine with it to form triple or double salt-like compounds, such as we meet with frequently in the mineral kingdom: common glass is also a compound of this nature. It must be observed, in passing, that silica generally combines rather with two bases than with only one.

Acids, even including carbonic acid, decompose the solution, and separate the silica in the gelatinous form. They act still more strongly and rapidly, even when diluted, upon the solid soluble glass, and separate the silica from it in the pulverulent form.

Salts with alkaline bases, especially carbonates and muriates, produce pasty precipitates, which are formed immediately, and coagulate the whole fluid when it is not too much diluted; otherwise they only make their appearance slowly. In this respect muriate of ammonia is peculiarly active, and produces a flocculent precipitate, with evolution of ammonia, even when the solution is greatly diluted: this precipitate, when washed for a long time with water acidulated with nitric acid, leaves pure silica.

The alkaline earths set free more or less potash from the solution, and combine with the silica and the rest of the potash to form double compounds, which are completely insoluble in water.

Alumina also combines with it to form a product insoluble in water, for which reason it is necessary to see that the quartz-sand which is employed in the preparation of the soluble glass bears no argillaceous particles with it. The insoluble paste produced in the solution of the fused glass probably arises principally from the alumina taken up by the glass

from the melting pot. If soluble glass be exposed to the air in solution in open vessels, it attracts carbonic acid, and undergoes decomposition, so that it coagulates in a longer or shorter time, and a gelatinous deposit gradually forms, which, according to Buchner's investigation, contains potash.

With the aid of heat, this change takes place much more rapidly than at the ordinary temperature; and if the solution be gradually evaporated in a dish on the evaporating furnace, and at last exposed to a stronger heat, in order to render it anhydrous, during which operation it becomes strongly inflated into a pumice-like mass, it is found afterwards to be for the most part decomposed, rendered insoluble in water, and capable of effervescing strongly with acids. By a slight red heat, however, it again returns to its original state, so that it may be completely dissolved in water.

From this it appears that when it is desired to prepare soluble glass in the solid state from its solution by evaporation, it must be kept constantly boiling, when the access of the carbonic acid is prevented by the steam. The same thing has to be taken into consideration in the solution of the crude fused glass; for which reason cold water must not be employed to replace that which is evaporated, because otherwise the boiling would be interrupted, and the access of carbonic acid would be permitted.

When solid, pulverized, soluble glass is exposed for some time to the air, it undergoes the same alterations as during evaporation; thus it effervesces strongly with acids, and only dissolves partially in water, leaving a strong sediment. But if the powder be calcined, it again dissolves completely. If drops of it be let fall upon the table or the floor, they soon lose their transparency, and become white, in consequence of partial decomposition. The same thing takes place when it is poured out of a glass vessel, in which case some of it frequently runs down on the outside, and remains adherent; it then soon after drying, forms white streaks, which cannot easily be got rid of. If it be preserved in a glass vessel which is not quite full or well stopped, a white ring is produced in course of time, and this adheres so firmly that it cannot be entirely got rid of, even with acids. At the same time a more or less considerable precipitate is formed at the bottom of the vessel.

If concentrated soluble glass be laid upon a solid material which imbibes it very little or not at all, such as glass, marble, thick paper, &c., it soon dries and forms a shining transparent varnish, which, however, does not long remain in this state, but gradually becomes dull, turbid, and sometimes cracked, and at last acquires a delicate dusty coating. This alteration is due to the fact that air-dried soluble glass still contains much water (about 12 per cent.), which it only loses slowly; and during this it always contracts more and more, and acquires considerable hardness.

One of the most excellent and important properties for technical purposes possessed by soluble glass, is that of binding and rendering coherent; it serves therefore to give loose masses density and a stronger cohesion, to unite separate parts of bodies, to combine small fragments into a larger whole, to fill up clefts and cracks, &c., in which direction

it has by no means attained all the applications of which it is capable. In this respect it may be compared with glue, and it might be called mineral glue.

Its efficacy is shown immediately when it is incorporated with solid and porous bodies which imbibe it, and when it is brought in contact with pulverulent, dusty, or sandy bodies, or such as may be crushed between the fingers; by this means these are converted into stony masses, and at the same time the glass loses its solubility in water.

These actions are dependent as to their degree upon the nature of the substances with which the soluble glass is brought in contact, as some attract and unite with it more strongly than others. In this respect the essential difference occurs, that with some, such as magnesia and oxide of zinc, a chemical combination takes place with the glass, whilst in other cases the only action is that of the adhesive power.

In the former the actions, namely hardening and insolubility, are easily intelligible, as an insoluble product is formed by the reception of a second base; in the latter it is not so easy to understand the process, especially as the behaviour of the soluble glass to bodies of different kinds differs considerably; for which reason also it is by no means a matter of indifference what body is selected when it is desired to prepare an intimate, solid, water-proof mixture. Thus, soluble glass gives a much greater adhesive tendency to powdered marble than to powdered quartz. That the carbonic acid of the air assists greatly in the consolidation of soluble glass is evident even from what has already been said regarding its partial decomposition by the action of the air: this, however, does not appear sufficient to explain the remarkable change which is often perceptible even in a few days. Carbonic acid certainly loosens the otherwise weak union between the silica and alkali; but, in the author's opinion, the silica does not behave passively, but, in accordance with its very peculiar nature, spontaneously acquires various states of coherence, and even assists actively, itself contracting, so to speak, and at the same time uniting so firmly with the bodies in contact with it, towards which it has a coherent tendency, that the whole becomes, as it were, petrified. With a mixture which does not bind in the desired manner, it is only necessary to add some material which enters into a chemical combination with the soluble glass, when the desired result is certain to be attained.

A good binding mixture of pulverulent or sandy materials with soluble glass, is called *soluble-glass mortar* by the author. In many cases, as we shall see hereafter, it may be employed with great advantage instead of the ordinary lime-mortar.

(To be Continued.)

Caselli's Pantographic Telegraph.

This instrument described in the *Bibliotheque Universelle de Geneve*, produces a fac-simile of the hand-writing of the dispatch. It is simply the instrument invented by Mr. Bain, a model of which was exhibited before the Franklin Institute by Dr. Swaim. The only novelty in this

reproduction is the mode of regulating the motion of the cylinders at the ends of the line, which is here done by electro-magnets, and was by Mr. Bain much better done by accurately adjusting two second pendulums. So high an authority as Prof. Dela Rive should be cautious how he lends his approbation to such pseudo-inventions.

To the Committee on Publications of the Franklin Institute.

GENTLEMEN:—Accompanying I submit for your examination, a report of experiments on wood gas, made in the retorts invented by me; also, a statement of the results of the operations at the Philadelphia Gas Works for the month of June of the present year. If you deem it worthy of publication, you will please order its insertion in the *Journal of the Institute.* Very respectfully,

C. M. CRESSON.

Report of Experiments on the Value of Wood Gases.

Messrs. JOHN C. CRESSON, CHAS. M. CRESSON, and LEMUEL H. DAVIS.

GENTLEMEN:—We herewith submit to you our Report on the value of wood gases. Our investigation consisted, first, in careful analysis of pine and oak wood gases; and secondly, in photometrical measurements, executed with great care and fidelity, and showing the illuminating power of the two varieties of wood gas in terms of the standard sperm candle. The wood gases analysed by us were collected in Philadelphia, in glass tubes carefully sealed before the blowpipe, and which, on examination previous to the analyses, were found to be free from flaws and perfectly tight. The pine wood gas was collected February 1st, and the oak wood gas February 2d. Both gases were manufactured at the old city or 9th Ward Gas Works, in retorts of the form patented by Dr. C. M. Cresson.

The pine wood employed was the so-called, "old field Virginia pine," cut a little over one year, and dried in the arches under the retorts, the temperature being about 60° Fah. It was probably not drier than wood dried under a shed. The oak wood was of the second growth, in small sticks, and of ordinary quality.

Both gases were purified by dry lime alone. The analyses were made in New York; the photometric measurements in Philadelphia, February 13th and 14th. In our analyses we have exclusively employed the method first introduced by Bunsen, and since then used by Frankland, Wetherill, and other chemists in pursuing similar investigations. We have satisfied ourselves by direct experiments, that this is the only one capable of yielding accurate results. The absorption of olefiant gas and hydro-carbon vapors by means of Bromine, appeared to furnish so rapid and simple a mode of determining these substances, that we considered it necessary to pay particular attention to this point. Experiments, however, showed that, while the method, when skilfully employed, does yield results of sufficient accuracy for ordinary purposes, it is far from giving the precision required in scientific investigations. In like manner, we have found that the absorption of carbonic oxide by a solution of

subchloride of copper in hyprochloric acid is not to be relied upon when great accuracy is desired.

The specific gravities of the gases were determined in the usual manner, without previous drying.

The following are the analytical results obtained expressed in volumes:

Pine wood Gas.	Spec. Grav.= 0·663	*Oak wood Gas.*	Spec. Grav.= 0·580
Hydrogen,	=32·71	Hydrogen,	=30·44
Light Carburetted do.	=21·50	Light Carburetted do.	=33·12
Olefiant gas and Hydro-carbon vapors,	=10·57	Olefiant gas and Hydro-carbon vapors,	= 6·46
Carbonic oxide,	=27·11	Carbonic oxide,	=26·11
Carbonic acid,	= 4·90	Carbonic acid,	= 0·48
Oxygen,	= 0·66	Oxygen,	=none.
Nitrogen,	= 2·55	Nitrogen,	= 3·39
	100·00		100·00

The photographic measurements were made in the dark chamber of the laboratory of the old City Gas Works in Philadelphia. Ritchie's photometer was employed, the standard being a sperm candle burning 120 grains per hour. It is also proper to state that the wood gases used in all these experiments flowed through about 500 feet of pipe before reaching the burners, about one-half of the pipe being exposed to the air of the atmosphere, while the other half passed through a cellar. The gas, as in the cases of that taken for the analyses, was the average of eight retorts with four hours charges.

The photometrical experiments were made by both of the chemists reporting to you, and are believed to be entirely reliable, every care having been taken to secure accuracy. The wood gas was, of course, burned from its own burner.

The experiments with the pine wood gas were made when the temperature of the atmosphere was 15° F., and the temperature of the cellar through which one-half of the supply pipe passed, 45° F.

The first series of nine experiments gave for the pine wood gas, when burning at the rate of 4·6 cubic feet per hour, an average illuminating power of 18·3 standard sperm candles; when burning at a consumption of five feet per hour, the average illuminating power was 18·2 candles.

The experiments with the oak wood gas were made when the external temperature was 15° F., and the temperature of the gas itself 48° F.

The mean of 10 careful determinations gave an illuminating power of 19·17 candles.

It will be remembered, that the average illuminating power of the Philadelphia City gas is between 17 and 18 standard candles.

As the circumstances under which both series of photometric determinations were made, were in all respects unfavorable to the wood gas, these results are to be considered as below a fair average. It is proper also to state that photometric measurements made with both kinds of wood gas, at the time when the two gases were collected for analyses, gave for the oak gas an illuminating power of 27 candles, the average of five observations; for the pine gas an illuminating power of 31 candles in one experiment.

In conclusion, gentlemen, we have only to express in a few words

the opinion which our experiments have compelled us to adopt, namely, that wood gas illuminating power is fully equal to the average of coal gas. All of which is respectfully submitted.

We submit also for your inspection, the results of our analysis of the gas of the Manhattan Company, in the City of New York, which, perhaps, may not be without interest. This gas was collected in the laboratory of the Free Academy, on the evening of February 5th.

Hydrogen, . .	= 42·98
Light carburetted hydrogen,	= 40·11
Olefiant gas and hydro-carbon vapors,	= 10·54
Carbonic oxide, . .	= 3·48
Carbonic acid, .	= 1·06
Oxygen, . .	= none.
Nitrogen, . . .	= 1·83
	100·00

The specific gravity of the gas was 0·570.

WOLCOTT GIBBS,

Prof. of Chemistry and Physics in the Free Academy in New York.

Philadelphia, February 14, 1856. DR. F. A. GENTH.

—

The results tabulated below, are taken from the books of the Philadelphia Gas Works. The product is from three beds of cellular retorts, with three retorts in each. In two of the beds, the retorts are adapted to the use of wood 6 feet in length, the others to lengths of 8 feet; the latter requires no more labor or fuel than the former, whilst the product is one-third greater. In case of renewal, it is proposed to make all the retorts of capacity sufficient for 8 feet lengths, when a greater economic result may be expected.

The wood for carbonization and fuel, is of the variety known in this market as "shore pine," and is of a decidedly inferior quality, it is freshly cut and exposed to the weather. Much better results are obtained during a dry season, both as regards the make of gas and quantity of lime required for purification. It is decidedly to the interest of the manufacturer to purchase well seasoned wood, and protect it by proper shedding. Should a future opportunity offer, the results of experiments upon various kinds of woods, as well as an average of the products, and also a maximum working for a considerable period will be given in like form, from which a much better idea of the commercial value of the apparatus may be derived. The cost per thousand it may be perceived, by the use of this apparatus, is considerably below that of coal gas, whilst the light produced foot per foot is almost identical. The hydrate of lime which is employed in purifying, is converted into a carbonate, and may be restored and re-used by burning in a suitable kiln and slaking. The demand for the by-products has, so far, exceeded the supply; but should they at any time become unsaleable, the cost of the gas would be about one dollar per thousand feet without making any reduction for the value of the charcoal as fuel.

Operations in Wood Gas for the month of June, 1857, *at the Philadelphia Gas Works.*

Date.	Wood carbonized. lbs.	Gas produced, cubic ft.	No. of retorts in action.	Wood used as fuel. lbs.	Bushels of lime to purify.	Make in feet per lb.
1	5850	30000	6	4000	48	5·11
2	5250	26000	6	4667	48	4·95
3	6300	29000	6	5333	48	4·60
4	6300	27000	6	5333	48	4·28
5	6300	27000	6	5333	48	4·28
6	9000	40000	9	5333	48	4·44
7	9000	44000	9	5333	72	4·88
8	9000	47000	9	5333	48	5·22
9	9000	44000	9	5333	72	4·88
10	9000	48000	9	5333	48	5·33
11	9000	45000	9	5333	72	5 00
12	9000	43000	9	5333	48	4·77
13	9000	44000	9	5333	72	4·88
14	9000	45000	9	5333	48	5·00
15	2600	14000	3	5333	72	5·38
16	8400	44000	9	5333	48	5·23
17	9000	45000	9	5333	72	5·00
18	9000	45000	9	5333	48	5·00
19	9000	47000	9	5333	72	5·22
20	9000	43000	9	5333	48	4·77
21	9000	49000	9	5333	72	5·44
22	9000	50000	9	5333	48	5·55
23	9000	46000	9	5333	72	5·11
24	9000	46000	9	5333	72	5·11
25	9000	44000	9	5333	72	4·88
26	9000	45000	9	5333	72	5 00
27	8400	42000	8·5	5333	72	5·00
28	9000	46000	9	5333	72	5·11
29	9000	49000	9	5333	72	5·44
30	9000	44000	9	5333	72	4·88
	247,400	1,238,000	8·28	149,324	1848	5·00

3720 bus. charcoal coarse. 960 bus. charcoal fine. Tar 450 gallons.

Financial Exhibit of the Wood Gas Department for the Month of June, 1857.

Dr.		Cr.	
To 136·8 cords wood, (carbonized and fuel) at 4·11,	$570·45	By 1,238,000 feet of gas at 2·00 pr 1000,	$2476·00
" hauling 136 8 cords, 0·25,	14·20	" 3720 bus charcoal at 10c.,	372·00
" 1848 bus. lime for purifier at 9c,	166·32	" 48 loads fine " 25c.,	12·00
" wages, Stockers, Purifiers, Yardmen, &c.,	367·88	" 1848 bus. lime at 4c.,	73·92
" coke for drying wood,	18·00	" 15 bbls. tar (30 gals. each) 450 galls. at 1c.,	4·50
" wear, tear, and renewals,	107·00		
" balance net gain,	1694·57		
	$2938·42		$2938·42
		By net gain month June,	$1694·57

The cost per thousand feet, (sales of by-products deducted,) is 67 cents, leaving, after making a proper allowance for distribution, a clear annual income of $16,600 from nine retorts, the cost of which with their connexions, would be about $2500.

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*On Engraving by Light and Electricity.**

A very interesting lecture, "On the Application of Light and Electricity to the production of Engravings—Photogalvanography," was recently read at the Royal Institution, by Thomas A. Malone, F. C. S., Director of the Laboratory in the London Institution. The subject is one with which the speaker has for some years been practically acquainted. In 1844, he experimented for many months upon the engraving process of M. Fizeau, of Paris, in conjunction with M. Claudet and M. Fizeau. Since that time he has closely watched all the steps of improvement that have been taken, down to the latest investigations of Talbot, Niepce de St. Victor, Pretsch, and Poitevin. The following is a report of the lecture :

The methods devised for the accomplishment of the certain perpetuation and cheap multiplication—by means of printer's ink and the ordinary printing presses—of the images of natural objects, as obtained in the camera obscura by the processes of ordinary photography, may be arranged under three great divisions.

The *first* method, in which light was used to aid the engraver's art, was almost coeval with the first attempts made to produce sun-drawn pictures. Indeed, it had been asserted† that photography and photographic engraving were invented between the years 1813 and 1827, by one man, Nicéphore Niepce, of Chalone on the Saône. A reference, however, to the *Journal of the Royal Institution*‡ would show that photography really sprang from the labors of Thomas Wedgwood and Humphrey Davy, as far back as the year 1802.

Although we cannot accord to Nicéphore Niepce the merit of originating photography, we must give him the undivided title of founder of the art of photographic engraving, and, moreover, acknowledge that he was the first to fix not only *a direct positive* photograph, but also to secure on metal and glass plates the images of the camera, and this long before Daguerre produced his wonderful plates. Niepce's method was beautifully simple. He took Jew's pitch or asphaltum, and upon it poured oil of lavender to resolve the bitumen into a varnish with which he could coat plates of metal or glass. A plate, coated and dried, was exposed to the light with an engraving super-imposed, or it was placed in the field of the camera obscura, and a photographic image was obtained on the varnished plate. This image was *not visible.* The plate had to be submitted to the solvent action of a mixed liquid, composed of one part of oil of lavender, and ten parts, by measure, of *white oil of petroleum*, or mineral naphtha. On immersion in this fluid, wherever the light

* From the Lond. Mech. Mag., April, 1857.

† By a correspondent in the *Mechanics' Magazine*, vol. lxv., pp. 277 and 326.

‡ *Journal of the Royal Institution*, vol. i. p. 170.

acted, the varnish became insoluble, and in a certain degree proportionately so to the intensity of the light. There were not only lights and shadows, but half tints. The picture, as soon as developed by the solvent, was removed, drained, and washed with water to check all further action. The shadows of the picture were now represented by the parts of the white metal or glass plate laid bare; the lights were given by the film of varnish which the light had hardened, and the solvent had left untouched. The plate, now finished, was capable of being etched by simply pouring engraver's acid upon its surface. The varnish would protect the metal over the lights of the picture; while the shadows, the bare metal, would be bitten in. On removing the varnish, the plate could be inked and printed from. Such are the essential details of the first of the photographic engraving processes. The specimens on the table of the Institution were presented in 1827 to Mr. Bauer, late of Kew, by Nicéphore Niepce, who for a short time resided at Kew, on a visit to a brother in infirm health. Niepce prepared a statement regarding his invention, for presentation to the Royal Society; but as he at that time kept his process secret, his manuscript was not published. Niepce appears to have returned to France, disappointed at his ill fortune.*

Niepce's bitumin process was improved by his nephew, M. Niepce de St. Victor, who has published a treatise† on it, giving the necessary minute instructions. The main features do not differ from those above given, though greater sensitiveness and perfection have been obtained. The process is still under trial; but the difficulties of obtaining a constantly uniform result at present stand in the way of its general adoption. It still deserves a thorough investigation.

The *second* method of producing photographic engravings is founded upon certain properties possessed by the Daguerrean image. It is found that a daguerreotype, unfixed by gold, is acted upon by nitric acid in its shadows, while the lights long resist the biting action of the acid. An etching is obtained by merely leaving diluted nitric acid in contact with the plate. The etched plate is then inked and printed from, as in Niepce's case. Dr. Donné, of Paris, appears to have been the first to devise this method; but the action is not easily controlled, and the process has fallen into disuse. In 1842, Mr. Grove published in the *Philosophical Magazine* a method by which Daguerre's images can be engraved by the chlorine evolved by voltaic action, when the daguerreotype plate is made the positive terminal of the battery, and immersed in diluted hydrochloric acid; the negative wire being terminated by a plate of platinum, which was placed opposite and parallel to the photographic image. This process is much more under control than the last, and is also worthy of further investigation. Here the image is truly drawn by light and *engraved by electricity.*

M. Fizeau, about the year 1844, also patented in this country, in conjunction with M. Claudet, a process for engraving the daguerreotype image. The speaker was instructed in this process by M. Fizeau, and

*The statement made by our correspondent, Dr. Lotsky, upon this subject, in the passage referred to in a preceding note, is thus confirmed.

†Traité Pratique de Gravure Heliographique, par M. Niepce de St. Victor. Paris, Juin, 1856.

worked for many months at its perfection. Results obtained both in France and England showed that in cases were great delicacy of delineation was required, as in certain anatomical subjects, this process had not been surpassed. It quite justified the formation of a second division of the available photographic engraving processes.

M. Fizeau, like Mr. Grove, availed himself of the affinity of chlorine for silver, but relied on chemical action for its application. He (M. Fizeau) made a solution of common salt and nitrite of potash in water, to which he added nitric acid. This mixed acid acted immediately when aided by warmth, upon the silver of Daguerre's plate, and left untouched the parts supposed to be completely covered by mercury. Chloride formed of silver was thus at once formed in the shadows of the images, and after some time in the half tints also. A very faint etching was thus produced. A prolonged application of the acid would not further deepen the etching, since the insoluble chloride of silver at first formed, protected the faintly etched parts from a further deepening corrosion. It was therefore necessary to remove the chloride of silver by washing with a solution of ammonia. This effected, the plate was ready for a second application of the acid; and by this alternation of solutions, the etching was increased in depth. But it was found that after a few applications of the acid the lights of the image also gave way. To remedy this was M. Fizeau's great aim; and he succeeded by heating the etched plate in a strong and boiling solution of caustic potash; after this the lights resisted the acid's action. The heating in potash is an important feature in M. Fizeau's process. As soon as the etching has been carried as far as possible by the acid mixture, the plate is dried and inked with fine printer's ink, and an impression may be immediately taken; but M. Fizeau prefers that the ink should be allowed to dry in the hollows of the plate, and gold deposited upon the bright parts by the electrotype process. On now removing the ink, ordinary diluted nitric acid may be safely applied to deepen still more the shadows. This last step causes M. Fizeau's etchings to possess greater vigor than those obtained by Donné's or Grove's processes. M. Fizeau, foreseeing that the wear and tear of the silver plates might be considerable, thought to use the electrotype process to produce fac-similes of the engraved plates, reserving the original plate unworn to supply any further demands. The patent right in this process will soon expire.

The processes of the *third* and last division were, it must be confessed, very desirable, notwithstanding the numerous satisfactory specimens obtained, and still to be obtained, by the processes previously described. The truth seemed to be that none of the processes gave uniformly satisfactory results: hence the necessity of being acquainted with the capabilities of all the chief known methods, and of impartially comparing them with a view to produce any special required result.

Mr. Henry Fox Talbot opens the third division by his gelatine and bichromate of potash process, in which a steel plate is covered with a liquified jelly, containing bichromate of potash in solution. This jelly is allowed to dry upon the plate, and the gelatined plate may be used to reproduce engravings or the images of the camera; the light, as in Niepce's case, altering and hardening the gelatine whenever it fell with

sufficient intensity. Nitric acid acts so energetically and so uncertainly on the steel plate, that but little success would attend its employment. Accordingly, Mr. Talbot was led to seek a better engraving liquid. This was found in a solution of bichloride of platinum, which appeared to act in the desired manner. The advantage of any process on steel plates would be obvious from the great number of impressions that so hard a body would yield under the wearing action of the printing press. It might here be observed that the bitumen process had also been applied to steel plates by M. Mante, in a series of natural history plates, published in Paris, and also by M. Niepce de St. Victor, in the frontispiece to his treatise.

In 1854, Herr Paul Pretsch, of the Imperial printing-office of Vienna, patented in this country, and subsequently in France, a process which he has called *Photogalvanography*. He uses Mr. Talbot's materials, but with certain additions, and avails himself of a property of the gelatine which allows of his dispensing with the acid etching altogether. This process was described by the lecturer in terms substantially the same as those employed in the description given at page 415 of the sixty-fourth volume of the *Mechanics' Magazine*.

In all the engraving processes hitherto described, there is a difficulty in obtaining a granular surface over the etched parts necessary to hold the amount of ink required by the printer. In Pretsch's process this difficulty remarkably enough does not present itself; the swelled surface breaks up in a direction vertical to its surface into little masses, which are just what is desired; this result is quite characteristic. It has been attributed to the presence of particles of chromate of silver, or of iodide of silver. Would it be too far-fetched to suppose that it is another beautiful instance of the slaty cleavage action demonstrated by Mr. Tyndall?* However this may be, the fact is very important for the success of the invention. The chemistry of the processes of the first and third divisions of this subject is but little advanced.

M. Poitevin, of Paris, has applied the gelatine and bichromate of potash process to lithographic stone, and his results would well bear a comparison with those obtained by the other methods described in this division.

The speaker, in conclusion, expressed his opinion that these engraving processes would greatly advance the art of photography itself, particularly in its applications to the delineation of colored objects, in which it is still very imperfect, although some progress has been made.

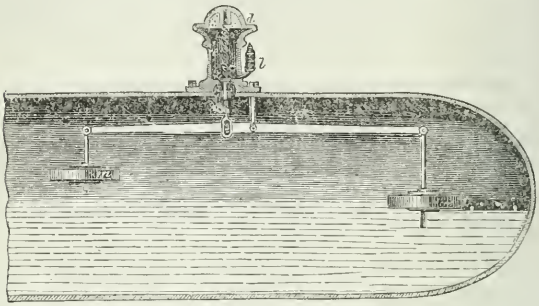
York's Indicator for Steam Boilers. †

This invention consists of an improved safety valve and low water, or high and low water indicator for steam boilers, as represented in the engraving. It has been patented by Mr. T. York, of Wolverhampton.

* We hope to give an account of of Dr. Tyndall's sagacious theory in an early number.—Ed. M. M.

† From the Lond. Mech. Mag., April, 1857.

a is a valve seat on the top of the boiler, upon which the valve, *b*, is pressed by the helical spring, *c*, the upper end of which bears against a shoulder on the dome, *d*, covering the box, *e*, in which the valve is contained. The dome, *d*, is perforated, as represented. A float, *f*, is suspended in the interior of the boiler from the end of a lever, *g*. A rod, *h*, jointed to the under side of the valve, *b*, is connected with the lever, *g*, by means of the slot, *i*, in which the pin, *k*, of the lever, *g*, engages,



so that the lever, *g*, has play within certain limits without affecting the valve; but when the water and float, *f*, descend below the proper level, the lever *g*, raises the valve, *b*, and permits of the discharge of the steam. As the steam escapes between the valve and valve seat, a portion of it is discharged into the whistle, *l*, and thereby gives notice to the engine-man that the water in the boiler is too low. The valve, *b*, acts as a safety valve when the water is at ordinary level, and rises whenever the pressure of the steam exceeds the pressure of the spring upon it.

A second float, *m*, is attached to the other end of the lever, *g*, as represented. If the water in the boiler rises too high, the float, *m*, becomes immersed, and raising the end of the lever, *g*, to which it is attached, lifts the valve, *b*, and the discharge of the steam and sound of the whistle, *l*, call the attention of the engine-man. The valve, *b*, thus acts as a safety valve and high and low water indicator.

Artificial White Sapphires.

Some ten years ago, the late M. Ebelman, then director of the government Porcelain Manufactory at Sèvres, succeeded in crystallizing alumina by slowly evaporating a solution of this substance in boracic acid, by the heat of his furnaces. The crystals thus produced were microscopic but possessed all the properties of the sapphire, ruby, &c., except the color. M. Gaudin states, in a communication made to the French Academy of Sciences, that he had succeeded ten years before

this, in making rubies artificially by calcining ammonia-alum with the addition of five thousandths of chromate of potassa, by the oxyhydrogen blow-pipe—but that the large globules were deficient in limpidity, owing to partial crystallization.

He now proposes the following process. Into an ordinary crucible lined with lamp-black, he introduces equal parts of alum and sulphate of potassa, previously calcined and powdered; the crucible is then submitted to a violent forge heat for a quarter of an hour. On breaking the crucible, there is found a mass studded with brilliant points, and consisting of sulphuret of potassium imbedding crystals of alumina. By dilute aqua-regia and heat, a precipitate resembling fine sand is obtained and must be washed several times.

The greater the mass operated on, the larger the crystals. Those obtained by M. Gaudin were 1 mm. ($\frac{1}{20}$-in.) in length; and about one-third thick. These are said to have proved upon trial, to be harder than the natural crystals, and therefore more fitted for mounting watches; they were perfectly limpid when examined under a powerful microscope, but cannot be obtained colored in this way, in consequence of the reducing power of the carbon.

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*Parchment Paper.**

At the Royal Institution, on the 3d inst., the Rev. J. Barlow gave a lecture on this subject. Mr. W. E. Gaine has discovered the remarkable fact, that by a momentary immersion of paper in strong sulphuric acid, diluted with half its bulk of water, and allowed to cool, and then instantly washing it free from acid, first in plenty of water, and then in weak ammonia, it becomes endowed with such extraordinary tenacity, that whereas a band of the original paper, of about an inch in width, breaks under a weight of seven or eight pounds; in its modified condition it will support nearly a hundred weight. The lecturer stated that Messrs. De La Rue & Co. had entered into an arrangement with the discoverer to introduce it into commerce, where, from its almost indestructibility, it will doubtless supersede parchment in many of its applications. Specimens of engravings were exhibited which had been so treated *after* having received the impression: the acid had in no way injured the lines of the engraving, whilst the great contraction which the paper underwent, gave a delicate softness and sharpness to the picture. Several photographs were likewise exhibited which had been printed on this parchment paper, as it is called, the peculiar hard nature of the surface enabling photographers, the inventor states, to obtain beautifully rich tones with far less expenditure of nitrate of silver than at present.

Mr. William Crookes, in a communication to the *Journal of the Photographic Society*, says:—

"On seeing the really wonderful change which had by this simple means been wrought in an engraving, the thought instantly occurred to me, what would be the effect of treating a finished photograph in this manner? We know of many instances in which a strong acid exerts

* From the Lond. Journ. of the Society of Arts, No. 231.

apparently less energetic action on bodies than the same acid diluted; and it was just possible that the metallic compound, whatever it may be, constituting the dark part of a positive paper photograph, might pass unscathed through the ordeal; the idea was at all events well worth putting to the test of experiment, and, accordingly, the same night, strips of photographs, selected as samples of different tones of printing, and various kinds of paper, were passed through the acid according to the plan above stated.

"The result was one which I had certainly not anticipated: the color and tint of the picture, even in the most delicate half-tones, remained perfectly intact, while the powerful yet uniform contraction of the paper added considerably to the sharpness; the paper was, besides, suddenly gifted with such great strength, that not only would it bear the roughest handling during the washing operation, without even the possibility of tearing it; but at any after-time, when finished and mounted, it would bear hard rubbing with soap and water and a wet cloth, without the slightest roughening or abrasion of the surface, if it were sufficiently dirty to render such a mode of treatment advantageous. Added to this, the surface (of an unalbumenized print) assumed a peculiar glossy appearance, giving a richer finish to the picture, without the glare which is so much objected to in albumenized pictures. Another effect, which time alone can decide whether or no it may be added to this long list of advantages, was this: a picture which was fading rapidly, was so treated on one-half only; there was a powerful odor of hydro-sulphuric acid evolved, and certainly there has been no further fading since, although the short space of time which has elapsed since trying the experiment, makes it difficult, as yet, to appreciate any difference between the two halves as regards their intensity."

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*On the Preparation of a Writing-ink in Cakes.** By A. Leonhardi.

After the author had discovered the mode of preparation of the so-called alizarine-ink, which is particularly useful, he was anxious to prepare it in a form which would allow it to be sent to a great distance and at any time of the year, render its transport convenient, and diminish its cost considerably, but at the same time fulfil all the requirements of an excellent article. This is attained by the dry alizarine-ink in cakes. The "ink-powders" hitherto found in commerce are not to be compared with it, for they not only possess a different composition, but never dissolve completely to form a clear solution in water, and their employment is attended with so many inconveniences and disadvantages, that they have been given up. Common black ink may indeed be evaporated to dryness, but it leaves a residue which does not again dissolve completely in water, and never furnishes a useful ink by this solution. The recipe for the preparation of the cake-ink is as follows:—

42 parts of Aleppo galls and 3 parts of Dutch madder are extracted with a sufficient quantity of hot water; the fluid is then filtered, 5½ parts of sulphate of iron are dissolved in it, and 2 parts of a solution of iron

* From the Lond. Chem. Gaz., No. 346.

in wood-vinegar, with $1\frac{1}{5}$ part of solution of indigo, are added to it. The mixture is evaporated to dryness at a moderate heat, and formed into cakes of a proper size (for instance 5 inches long, $3\frac{1}{2}$ inches broad, and $\frac{3}{8}$-inch thick).

1 part of thisc ake-ink dissolved in 6 parts of hot water, furnishes an excellent writing and copying ink, whilst even with 1 part of cake-ink and 10 to 15 parts of water, beautiful writing-inks are obtained.—*Mittheil. des Gewerbe-vereins für das Königr. Hannover*, 1856, p. 249.

On some Modifications of Woody Fibres and their Applications.

By the Rev. J. Barlow.

Having called attention to the chief physical peculiarities of woody fibre,—strength, flexibility, elasticity, combined with readiness to take a permanent set or bend, Mr. Barlow first noticed the ingenious application of these qualities devised by Mr. T. Blanchard, of New York, and adopted by the Timber Bending Company. Large beams of timber can be made by end pressure, to take any amount of flexure, are strongest in the bent portions, and yet will break before they can be straightened by mechanical force. Mr. Barlow then referred to the known chemical composition of woody fibre—the material of paper—as consisting of carbon, and of hydrogen and oxygen, in the same proportion as these elements exist in water. Although extremely averse to chemical change, this, in common with other organic substances, has been made to exchange a certain amount of its hydrogen constituent for an equivalent amount of hyponitric acid (NO_4). The discoveries of Braconnet, Pelouze, and Schönbein were briefly adverted to. It was shown, that paper, as operated on by Pelouze's process, is a substitution-product, and, consequently, increased in weight. It is also both combustible and electrical in the highest degree. In reference to this subject, Mr. Barlow invited attention to some recent experiments of M. Kuhlmann, of Lille,—the results of which the courtesy of that gentleman enabled him to exhibit to the meeting. M. Kuhlmann has ascertained that no form of gun-cotton, whether woven or not, will receive dyes, but that when it has lost part of its nitrous principle, by spontaneous or artificially produced decomposition, the vegetable fibre absorbs colors more energetically than it did in its natural state. But the chief subject of Mr. Barlow's discourse, was supplied by a recently invented method of investing ordinary paper with many of the most useful properties of parchment, and also of imparting to it some qualities which parchment does not possess. This discovery was made and patented by W. E. Gaine, Esq., C. E., and it is about to be introduced into commerce by Messrs. Thomas De La Rue & Co. That cold solutions of caustic alkali and chloride of zinc, as well as sulphuric acid, impart strength and fineness to textile fabrics, was discovered some years since, by Mr. J. Mercer; and the fact has been scientifically investigated by Dr. L. Playfair, C. B., and also by Dr. Gladstone. Mr. Gaine ascertained that, of these reagents, sulphuric acid alone was applicable to paper. The effect he

* From the Lond. Athenæum, April, 1857.

sought to accomplish was best attained by merely drawing a piece of common unsized paper, through a mixture of two parts of concentrated sulphuric acid with one part of water, and then immediately and thoroughly washing it in water. If the acid either exceeds or falls below the above-named strength, then the quality of the "*parchment paper*" (the name by which the substance thus produced is to be designated) is deteriorated. It is, in fact, at this strength only that the acid produces its full sizing effect, and enables the paper parchment to bear writing ink. Parchment paper thus prepared, is so strong, that a ring of it ⅞-inch in width will sustain from 63 to 100 lbs., (a ring of parchment of the same weight and dimensions supporting about 56 lbs.) Parchment paper, though it absorbs water, does not permit water to percolate through it. It is not disintegrated by water, and (unlike parchment) is not destroyed by warmth and moisture. The weight of the paper is not augmented by its conversion into parchment paper, proving the entire absence of sulphuric acid. The strength of this substance, and its resemblance to parchment, commend it for purposes in which strength and durability are requisite; such as legal deeds, policies of insurance, scrip-certificates, books subject to great wear and often referred to, (as school books, registers, &c.) Having all the appearance of vellum, it is likely to supercede the use of that substance in book-binding. It is also suitable for receiving oil colors. A map and a lithographed engraving, which had been subjected to this process, were exhibited. The smoothness of their surface, and their perfect condition, led to the expectation, that prints thus prepared, were not likely soon to become soiled, and that, whenever this occurred, they might be easily and safely cleaned. This extraordinary conversion, effected in a moment of time, rendering that which was previously weak, porous, and disintegrable, a substance of singular toughness, through which water cannot flow, neither disintegrate it, cannot be easily accounted for. It must, for the present, be referred to that mysterious influence, by which bodies occasionally seem to effect, by their mere presence, changes in other bodies, themselves remaining unaltered. *Proceedings of the Royal Inst., April 3d*, 1857.

Smokeless Furnaces.

M. Dumery from a committee appointed to report upon an apparatus for slow combustion, erected in the Museum of Natural History, at Paris, reports to M. Flourens, the Director, that,

1. The quantity of fuel (*charbon*,) consumed per area of grate, may, in this new apparatus, vary in the ratio of 1 to 8 without producing smoke, and without a loss of advantage greater than from 3 to 2·2.

2. That the advantages obtained are greater in proportion as the quantity consumed in a given time per square foot of grate surface is less: in other words, while with a consumption of 26 lbs. per square foot, the economy was 22 per cent., when the consumption was lowered to one-third of this, the gain was 30 per cent. over the ordinary furnaces working under the same conditions.—*Academy of Sciences of Paris, 6th April*, 1857.

*Artificial Fuel for Burning Bricks.**

Mr. C D. Gardissal, of Bedford Street, Strand, has patented a new combustible compound, composed of clay, coal-dust, and a nitrate, or nitric acid. The essential base is clay or marl, and a mixture of both; this base is worked up with a solution of alum, a certain quantity of nitrate of soda, or potash, and charcoal, or other coal-dust; the largest particles should not exceed the size of small peas. All the materials foreign to the clay combine with, and are diffused throughout the whole mass, in the proportion of about 17 per cent. These combustible bricks not only bake the others in the kiln, but bake themselves, and are removed from the kiln perfectly porous bricks, which may be used for the same purpose as ordinary ones.

Moulds of Stearic Acid and Shell-lac for Galvanoplastic Copies. By M. Phil.†

The best material for moulds is prepared from equal parts of stearic acid and shell-lac. The stearic acid is melted first, and the shell-lac is then added in small fragments; the mass is heated until it may be ignited. It is allowed to burn until the shell-lac which has been separated from the stearic acid by the great heat, may be again combined with it. It is burnt until a drop let fall upon a cold metal plate receives the black lead readily after its solidification. The mass is poured into a paper box, and its surface rubbed with black lead.—*Polyt. Notizblatt*, No. 13, p. 193.

The Telescopic Stereoscope.‡

To the Editors of the Philosophical Magazine and Journal.

Gentlemen:—Since sending you the account of the stereoscopes proposed by myself and Mr. Waterston for uniting large binocular pictures, my attention has been called to a description, contained in Sir David Brewster's Treatise on the Stereoscope, of an instrument so nearly resembling what I have called the telescopic stereoscope, that, had it not entirely escaped my recollection, I would never have spoken of mine as new. The only difference, beyond unimportant details, is that the instrument described by Sir David Brewster appears to have been intended only for small pictures near at hand, while mine was designed to unite large pictures viewed at a distance. The latter object *alone* being that which I had in view, and recollecting no description of any instrument *for that purpose* in Sir David's work, it did not occur to me to search the volume again before sending you my account, although I endeavored in every other way to ascertain if such a form of the stereoscope had ever made its appearance. I now, however, take the very earliest opportunity of making the acknowledgment, and hope you will be able to give it a place in your forthcoming Number.

Edinburgh, Feb. 10, 1857. James Elliot.

*From the Lond. Mining Journal, No. 1129.
†From the Lond. Chem. Gaz. No. 351.
‡From the Lond., Edin., and Dub. Philos. Mag., March, 1857.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, July 16, 1857.

John Agnew, Vice President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were received from the Smithsonian Institution, and Prof. A. D. Bache, Superintendent of the U. S. Coast Survey, Washington, D. C.; The Ohio Mechanics' Institute, Cincinnati, Ohio, and Messrs. Caldwell and Ghrisky, Ellwood Morris and Wm. H. Jones, Philadelphia.

Donations to the Cabinets of Models and Minerals from Isaac R. Tremble, Esq., Baltimore, Maryland, Messrs. Williams & Page, Boston Mass., and John C. Trautwine, Esq., Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for the month of June was read.

The Board of Managers and Standing Committees reported their minutes.

New candidates for membership in the Institute (3) were proposed, and the candidates (3) proposed at the last meeting were duly elected.

A specimen of scale-encrusted tube, taken from an ocean steamer, was laid upon the table. It was a section of a vertical tube, covered evenly with calcareous deposit, about five-sixteenths thick. The material of the tube (brass,) did not seem injured, as might be expected, from being coated with so thick a non-conductor; probably being preserved by the rapid circulation of water incident to vertical tubes. When it is considered how easily the interior of tubes are cleaned, such instances can only occur through wilful neglect. Some of the Government steamers, having boilers similar to the one from which the tube was taken, have been almost constantly in service, and have never had scale of a greater thickness than that of an egg shell upon the tubes.

Mr. C. Brigham exhibited his design for a cast iron rail for city passenger railroad. Its peculiarities are: no ties are needed, a flanch cast on the under side gives a sufficient base; at the top, on each side, are a series of angular projections flush with the top or head of the rail, on the outer side, while on the inner side they are below (about half an inch,) sufficiently to clear the wheel flanches; between the projections on the outside, cubical blocks are to be fitted, and on the inside the ordinary cobble stones are to be put.

It is claimed that the cast iron projections will prevent the wearing of the stones into ruts by vehicles, the spaces between the projections being but about nine inches: wheels of ordinary vehicles would not sink or wear away the stone blocks to any injurious amount, before the abrasion would be arrested by the wheels coming in contact with the hard material of the casting. It is expected that the difficulty experienced in crossing railroads on an angle will be greatly reduced from the

trifling difference in the level of the inner and outer projections, which represent the paving on the inside and outside of road, and which will not be increased by ruts.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Dr. Charles M. Cresson's Cellular Gas Retort.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination the Cellular Gas Retorts, invented by Dr. Charles M. Cresson, of Philadelphia, Penn.,

Report:—That the invention consists in arranging a system of cells in the walls and especially in the bottoms of the retorts, which cells are so connected, by omitting the dividing walls alternately at the two ends, as to constitute a continuous passage, opening at one end into the retort, and at the other, giving exit to the gas into the main. In this way the gas is maintained for a considerable time at a moderate red heat while it slowly traverses this passage. In the retorts in use at the Philadelphia Gas Works, the cells are in the bottoms of the retorts only, and are eight in number in each retort, each two inches wide, four inches deep, and six feet long; so that the gas is made to traverse slowly a space of 48 feet, and during the time thus occupied, is subjected to a regulated and moderate temperature.

The effect of such an arrangement is two-fold; in the first place, it must modify, to a considerable extent, the temperature of the body of the retort itself, which has thus interposed between it and the heat of the furnace-flues, the gases contained in the cells. The retorts will thus be less violently and more steadily heated, and the nature of the gases developed, may, as is well known, be thus considerably modified.

Secondly, it would seem possible that a material change in the chemical nature of the gases may be produced by the maintenance of this temperature for a considerable time.

Heretofore, these retorts have been exclusively employed in the manufacture of gas from wood, and the practical result has been that, whereas, according to the experience of the gas works in the City of New York, the gas from wood manufactured in the ordinary retort cannot be economically used, owing to its low illuminating power; the gas from wood manufactured in this city in the cellular retort, exhibits at the present prices of wood and coal, a slight superiority in economical value over coal-gas. The wood used has been principally common pine, and, as the apparatus has been used merely as an adjunct to the coal-works, and is comparatively on a small scale, no provision has been made for properly seasoning, drying, or splitting the wood. For the most part the wood had been distilled in large sticks, dried for a few hours only, and requiring some four hours to exhaust the volatile matters. Experiment, however, has shown that the capacity of the apparatus can be largely increased by diminishing the diameter of the wood, and by thorough drying. By proper attention to these points, the same weight of charge can be burned off in 1½ hours with an increased yield

of gas per pound. In this way, a retort that will yield ordinarily 4500 cubic feet of gas in 24 hours, can be made to produce over 9000 cubic feet in the same time. By careful working, 10,000 cubic feet have been obtained with the same amount of fuel and labor as are ordinarily used for two-thirds that amount of coal-gas.

The following are the statements of the results actually obtained with these retorts:—

Experimental Trials.

April 29 and 30, 1856. 6 retorts in action—duration of trial 48 hours.
Large pine wood—3 hours charges.
14,400 pounds of wood produced 76,000 cubic feet of gas,
Being 5·27 cubic feet to pound, or 15,800 cubic feet to cord. 6333 cubic feet to retort in 24 hours.

June 12 and 13, 1856. 6 retorts—3 hours charges—duration of trial 48 hours.
Pine wood split and partially dried.
12,000 pounds of wood produced 76,000 cubic feet of gas,
Being 6·33 cubic feet to pound, or 18,900 cubic feet to cord.

July 31st, 1856. 6 retorts—hourly charges.
Pine wood, split small, and dried.
14,400 pounds produced 62,000 cubic feet of gas,
Being 4·30 cubic feet to pound, or 12,900 cubic feet to cord.

In this trial the charges were not thoroughly burned off—the charcoal being smaller but of better quality.
10,333 cubic feet to retort in 21 hours.

March 1, 1855, *to March* 1, 1856.

Wood used in retorts.	Gas produced.	Fuel used, (coke exclusively.)
2,896,578 lbs.	11,860,425 cu. ft.	33,906 bus.

Average make per pound for year, 4·09 cubic feet.
equal to 12,200 cubic feet per cord.
Maximum monthly make = 4·83 cub. ft. per pound.
equal to 14,490 cub. ft. to cord.
350 cubic feet of gas were produced for each bushel of coke used as fuel.

March 1, 1856, *to March* 1, 1857.

Wood used in retorts.	Gas produced.	Fuel used, (wood exclusively.)
1,840,265 lbs.	8,306,000 cub. ft.	1,380,000 lbs.

Average make per pound for year, 4·51 cubic feet.
equal to 13,530 cub. ft. per cord.
Maximum monthly make, 5·61 cub. ft. per pound.
equal to 16,830 cub. ft. per cord.
Average charge 137 pounds per retort.
" retorts in action 6.
Yearly production per retort 1,384,333 cubic feet.
Average duration of retorts, 12 months.
18,000 cub. feet of gas produced per cord of wood as fuel.

As every invention by which the price of gas is diminished, either by increasing the yield, by diminishing the first cost of the apparatus, or the expense of its maintenance, or by substituting other materials for those which have been heretofore exclusively used in this manufacture, is of the greatest importance to the community, the committee deem the gas retorts of Dr. Cresson to be a very valuable improvement, and recommend them to the attention of those engaged in the manufacture of illuminating gas.

By order of the Committee,

Philadelphia, June 11th, 1857. WILLIAM HAMILTON, *Actuary.*

Messrs. Butcher's Composition for Coating Iron.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "a Composition and Process for Coating Sheet Iron to be used for Roofing," &c., invented by Messrs. Wm. Butcher & Son, of Philadelphia, Penna.

Report:—That the iron is prepared by heating to a point below redness, and plunging it into a bath of preparation or coating consisting of linseed oil, gum-elastic, lead, and other ingredients, made known to the Committee, the iron thus coated is finished by baking until the surface is dry; it then presents a tolerably even surface of elastic varnish or japan, which possessing considerable flexibility, enables the iron to be folded short without cracking or scaling, and from its close adhesion to the iron prevents the action of atmospheric moisture.

The numerous joints made when turned plates are soldered together to form a roof, are a very objectionable feature in the use of that material, as the roof becomes leaky mostly at the soldered joints, which is due to galvanic action from moisture getting to the metal through the imperfect coating of paint which is applied with a brush, and cannot be covered so well as in the process patented by Messrs. Butcher.

The length of the sheets of prepared iron is such that but few joints are required in a roof of ordinary size, and these are made by folding in such a way as to allow for expansion and contraction due to atmospheric changes.

The spouts or guttering made of the prepared iron, appears to be far more durable than tinned iron, as the tube is coated after it is formed, and is protected by the composition within and without.

The Committee can see no reason why the prepared iron of Messrs. Butcher should not be used as a valuable material for roofing, especially as a substitute for tinned plate, as its first cost is less and having fewer joints, must be less liable to leak.

By order of the Committee,

Philadelphia, July 9th, 1857. William Hamilton, *Actuary.*

BIBLIOGRAPHICAL NOTICE.

Hand-book of Railroad Construction. By George L. Vose, Civ. Eng. Published by L. Munroe & Co.: Boston, 1857.

We have been presented with a copy of this valuable work for the Library of the Institute.

It is an octavo volume of 480 pages, illustrated by 158 wood engravings.

It commences with an introduction, giving a brief sketch of the history of railroads, and the general principles controlling their construction and operation.

Then follow sixteen chapters, detailing the various operations from the reconnoisance of the route, through all the minutiæ of construction, down to the final equipment, and the after management in operation.

The chapters on *survey*, *location*, *bridging*, *equipment*, and *management*, are particularly valuable.

A work of this kind to combine properly the experience of the engineering profession, must necessarily be, to a great extent, a compilation —and this the author frankly admits. For our own parts, we must say that the compilation is extremely judicious, and that it is interspersed throughout with original matter of the highest value.

We consider this work a very useful one, both to the engineer and the general reader, and recommend it to the notice of the public with great pleasure.

There are a few points in this book which we hope to see corrected in the next edition, which we have no doubt will soon be called for.

1. The use of the terms "*grade*" and "*sub-grade*," (p. 57,) have always seemed to us unnecessary—let the grade line of the profile represent top bank or bottom cut, both being continuations of the same plane, and work from this plane in the establishment of every thing. Some of our best engineers work from *grade alone* on railroads, or *bottom* on canals, and the line called sub-grade, seems to be an unnecessary innovation or complication.

2. Wire suspension bridges, (p. 204,) are treated as an "*American Plan.*" This is not historically correct. Wire bridges were first projected and used upon the continent of Europe, by M. Seguin of Lyons, in 1823, and were first introduced into this country (in 1841,) by Charles Ellet, Jr., Esq., Civ. Eng., after viewing the wire bridges of Europe, several fine examples of which were then in use.

To the distinguished engineer, last mentioned, also belongs the merit of first demonstrating the applicability of wire suspension bridges to railways, which Mr. Roebling, at Niagara, has so successfully carried out by the adoption in part of Mr. Ellet's views.

3. In laying railway track it is recommended (p. 284,) to place two joints always on one cross-tie. This is one of the most singular heresies prevailing among a portion of the engineering profession—it is well known that a joint is always the weakest point in the track. To combine or duplicate this weakness upon a single tie, it is an error which always produces a depression in the rails, and a shock in passing more or less violent; it is well known to be unsafe to drive an ordinary carriage at speed *squarely* over a gutter, and an experienced charioteer will always cross such obstructions *obliquely*. On common roads as upon railroads, unavoidable obstacles should be met and overcome in detail. Some of our best railroads are laid with "*broken joints*," and some of those originally laid with "*joints opposite*," have since been, or now are, in the process of being altered, and we have no doubt, that in a few years, opposite joints upon the same cross-tie will be unknown.

4. The invention of plotted or graphic time-tables, is ascribed to Mr. Post of the Erie Railroad, (p. 443.) This is clearly an error, as this method of graphic time-tables was originally devised by the late Major G. W. Whistler, Civ. Eng., more than twenty years ago, and fully described in an account of the Long Island Railroad, published in 1838.

We do not by any means introduce these points for the purpose of detracting in the least degree from the real merit of this valuable engineering work, but merely for the purpose of invoking to them the consideration of the author in the future editions of this meritorious book.

E. M.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

SEPTEMBER, 1857.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Practical Views on the Proposed Improvement of the Ohio River. By W. Milnor Roberts, Civil Engineer.

(Continued from page 85.)

If it is so difficult, not to say impracticable, to control the freshets of the Ohio River, how can we, as practical investigators, indulge a hope of regulating the great floods of the Mississippi? Even as high up the river as the City of St. Louis, two hundred miles above the entrance of the Ohio, and *excluding* the area drained by the entire Ohio River and all its branches, there are over *five hundred thousand* square miles of territory drained by the Mississippi and Missouri waters; being *twenty times* the Ohio drainage above Wheeling, which we have hitherto been investigating. How are we to arrest "the turbid waters of the Missouri and Mississippi, and make them to flow forever, with a constant, deep, and limpid stream?"

And how is it with the formidable suggestion, that "reservoirs may eventually be made to hold *all* the annual excess, and make the daily flow almost entirely uniform?"

We have shown the inadequacy of sixteen 50 feet dams for the Ohio River; suppose we add two more on the Monongahela, two on the Big Beaver, two on the Youghiougheny, two on the Kiskiminetas, two on French Creek, two on the Clarion, and one more above Olean on the Allegheny. Each of the two on the Monongahela might contain one-half more than one on the Allegheny, the other eleven would not probably contain an average exceeding three-fourths of one on the Allegheny. These 13 additional large reservoirs, upon a liberal estimate, might contain 70,000,000,000, cubic feet, making for the whole 29

reservoirs, 173,000,000,000 cubic feet, occupying all the main rivers and principal branches. Now, the quantity of water which flowed past Wheeling in 1847, as calculated by Mr. Ellet, was 1,142,258,000,000 cubic feet. All these reservoirs would hold only about *one-sixth* of the drainage of that year. This simple fact of itself should impress us with the magnitude of the undertaking to reduce this immense flow to uniformity, especially when we recollect that a single flood of a few days continuance will fill all these reservoirs.

Mr. Ellet shows, that a flood in March, 1841, the highest part of which was only 32 feet at Wheeling, discharged during *eleven* consecutive days, water enough to have more than filled all these reservoirs, and they would have been two-thirds full, or more, when this flood came. The flow in the month of December, 1847, would have filled these 29 reservoirs $1\frac{1}{4}$ times; and immediately after, on the top of these overflowing reservoirs, came the flood of January, 1848, which rose to 23 feet on the 3d, and to 26 feet on the 6th. How, under such irregular movements of the river floods, could we exert any useful control? And yet, what have we assumed to be done? We have erected dams of 50 feet height, placed continuously, beginning at Wheeling, and occupying the Ohio, the Allegheny, the Monongahela, and their principal branches; destroying the present navigation of all of them, substituting therefor a navigation composed of 50 feet dams, with some peculiar and novel arrangement of locks! We have assumed all this, and what do we accomplish? We secure a radical improvement of the Ohio River, but is it not at the cost of the destruction of every thing above the point where the improvement begins? Granted, then, that even at this cost the river may be improved, have we advanced one step towards regulating the flow of great floods? Let the accumulated facts herein arrayed, decide.

In another part of Mr. Ellet's paper, is this suggestion: "Yet as all the objections that can possibly be urged against the construction of high dams on these great rivers may be obviated, as already stated, by resorting to the smaller affluents, it will be the aim of the writer to make a *first demonstration* of his plan in localities remote from the leading channels of trade, and where there are no important private interests to be consulted."

If we discard dams of great height on the main rivers on account of difficulties that may be attendant upon their erection, and the anticipated injury to navigation interests above Pittsburgh, resort must, of course, be had to the upper waters, as above indicated. Suppose it possible to find sites for *five hundred* reservoirs, each having the capacity of the present Conemaugh reservoir, (466,000,000 cubic feet,) their united contents would be but 233,000,000,000 cubic feet, or a trifle over *one-fifth* of the quantity which flowed past Wheeling in 1847. And, had all these 500 reservoirs been in use, and entirely empty, on the 22d of January, 1840, they must have been filled to overflowing before the middle of February; and in the latter part of the same month, there was a flood of 36 feet height, to be regulated with every reservoir full! During that single short month, there flowed past Wheeling 307,046,000,000 cubic feet, or about *one-third* more than the aggregate capacity of these 500 reservoirs.

Again, in further exemplification of the particular point under discussion, if it were *possible* to locate reservoirs enough to contain the *entire drainage* of *a year*, such as 1845, when 555,482,000,000 cubic feet passed Wheeling. Another year, 1847, shows greatly more than *double* of that quantity passing the same point of observation; leaving 586,776,000,000 cubic feet unprovided for. Each one of these reservoirs would require the drainage of at least seventeen square miles. Now, let an attempt be made to locate 500 reservoirs, embracing localities each covering 17 square miles; or 250 reservoirs, each covering a locality of 34 square miles of drainage. In either case, practical difficulties will be encountered, greater than Mr. Ellet could have thought of at the time he wrote.

The writer, after investigating the records, with a view to the elucidation of this important feature of Mr. Ellet's plan of controlling great floods, is constrained to adopt the opinion, founded upon those records, that it cannot be practically carried out now, or at any future time.

And further, unless expense, damages, health, and navigation interests above Pittsburgh, be entirely disregarded, there are, it seems to the writer, two things proposed which are *not compatible with each other.* One, a system for maintaining the flow in the Ohio at all times up to 6 feet: the other, to prevent the flow from going materially above a uniform height. In one, we need only reservoirs enough to hold the quantity required to raise it from its low stage to 6 feet; in the other, vast river dams, or numerous reservoirs, (or both,) covering the best part of the country! The chief object in one case, is to *hold the water* back, and in the other to *let it go.* In one case we desire well filled reservoirs, in the other we must have them empty, or partially so, or they can be of no avail.

In the foregoing approximate estimates of quantities of water likely to be held by reservoirs, accuracy could not be expected. They are derived legitimately from such data, aided by experience, as to warrant the opinion that they are not likely to prove grossly erroneous; or sufficiently erroneous to alter the general conclusions. This inquiry is not conducted with the view of establishing any particular theory, but to bring the facts fairly before all. They show, at least, that reservoir sites suitable for such gigantic operations, are not so numerous, or so easily attainable, as the public may have been led to suppose. Reservoirs have become so common in connexion with canals and ordinary sluice navigation on minor rivers, such as the Lehigh, and the smaller tributaries of the Allegheny, that the transition to a much larger scale of operations, appears simple and easy. But what, in extent, are the supplies of water for canals, compared with the quantity contained in the flow of a river like the Ohio, at a regular six feet stage?

As a familiar example, take the old Erie Canal in New York, 365 *miles* long, with 40 feet water surface, 28 feet bottom width, and 4 feet depth. This prism would contain 262,099,920 cubic feet. A single day's supply through the dry season for the Ohio River, upon Mr. Ellet's theory, would fill that prism of 365 miles length, more than 4 *times.* A single one of the 500 smaller reservoirs already described, would fill it, and have 203,900,080 cubic feet to spare. This conveys a more

tangible idea than the mere rehearsal of millions of cubic feet. But pursue the comparison a little further: allow that it would require on these 365 miles, 100 cubic feet per mile per minute, to keep up the loss from evaporation, soakage, and leakage, and that 100 boats per day should be passed through locks of 8 feet lift, with chambers 90 feet long and 15 feet wide: the total daily quantity would be 53,640,000 cubic feet. More than *twenty-one* times this quantity would be used in supplying the Ohio River, as proposed, for one day.

There is another practical consideration, already merely glanced at, which we dare not ignore—namely, the probable effect of such a system of reservoirs as that recommended by Mr. Ellet, upon the health of the country. B. Ayerigg, Esq., a Civil Engineer of superior attainments and judgment, formerly engaged in the service of the State of Pennsylvania, makes this remark in referring to this subject: "there may be water enough and places enough if we disregard expense, and the health in the vicinity of large areas, alternately covered with water and exposed to the sun." Mr. Ayerigg is familiar with this region; he made the surveys for a continuous canal across the Allegheny mountains, and proved conclusively, that by means of reservoirs on the head waters of the Susquehanna and Allegheny, it could be supplied with water. He also had charge of the slackwater improvement on the Allegheny River, which was commenced by the same State, and afterwards abandoned from notions of policy which had no reference to the capabilities of the river. Mr. Ayerigg's opinion was decisively in favor of improving the Allegheny, to a certain extent, by slackwater, with dams of moderate height.

Whilst admitting that a *few* sites for reservoirs can be found not subject to serious objection on the score of health, the writer apprehends that an *extended system* of reservoirs, such as would seem to be necessary in bringing about any practical control of the Ohio River, might destroy the salubrity of large areas of country; and that it might happen, that neither any state nor the general government could sustain it. The writer is acquainted with two instances in the State of Ohio, one on the Sandy and Beaver Canal, and the other on the State Canal of Ohio, where reservoirs were forcibly torn down, and the waters let off by the populace, upon the plea, whether true or false, that they were injurious to the health of the people living around them. Nevertheless, he would not be misunderstood; his own opinion is, that it does not precisely follow, that the construction of a reservoir always endangers the health of the surrounding inhabitants. Something depends upon the character of the reservoir, and the manner of using it. But this point is entitled to grave consideration. We will next take up the subject of *low open dams.*

Low Dams with Open Sluice Ways.

Mr. Haupt, in his pamphlet published in 1855, entitled, "A Consideration of the Plans proposed for the Improvement of the Ohio River," introduces his own plan of low dams, as follows:—

"The case which has been considered is, that of an application of the ordinary slackwater principle, by means of high dams and locks. The

objections to it appear to be numerous and formidable, but not insurmountable, and the importance to the general interests of the country of an uninterrupted navigation, would be sufficient to justify the expenditure if it were quadrupled. A system of low dams, with chutes of very moderate inclination, would be free from the delays of lockage; would oppose less obstruction to floods; would be less expensive in first cost, and less expensive in operation, and would throw but little impediment in the way of the descending coal and lumber trade."

This would be in the main true, if the plan did not require "artificial reservoirs," but as these necessarily constitute part of the plan, and as the erection of artificial reservoirs on the large scale required, is not yet decided to be easily practicable, this statement of conclusions must be received with some allowance for the present.

On the precise plan recommended by Mr. Haupt, there are other and more serious objections.

These low dams are to be without locks, to be open at one end for 200 feet in width left for a channel, with a mound in the river, extending from the end of each dam upward, lengthwise of each pool, forming, as it were, a *canal* on one side of the river. The plan, theoretically, is neatly elaborated; but Mr. Haupt did not pursue it minutely through all its practical bearings. The difficulties inseparable from this peculiar arrangement, have been ably discussed in the paper of Mr. Morris, before mentioned. It would occupy much unnecessary space to repeat the whole of Mr. Morris' argument. The chief and vital objections are, that whilst one side of the river would thus be accommodated with a good ascending navigation for steamers, and a good descending navigation for rafts and arks, the other side of the river would be excluded from all participation, in consequence of the dam, and the mound along each pool, —the dam and mound together forming a *cul de sac*,—and in descending with steamers, even in the channel of such confined width, there would not be room to *round to* for landing. To reach any place above and near to a dam, on the opposite side from the channel, steamers would be forced to double the cape of the mound, whatever number of miles it might be. And secondly, the accumulation of sand and gravel, immediately opposite the mouths of the numerous tributaries pouring across this narrow canal, would obstruct and destroy the usefulness of the channel.

Although this plan requires artificial reservoirs, it would obviously need less aid from such supply, than Mr. Ellet's plan of keeping up the natural river.

A modification of the foregoing plan, dispensing with the mounds, and placing the channel at or near the middle of the stream, relieves it of both of the above serious objections. In this form, it is worthy of careful consideration.

Assuming that the present extreme low water depth on the bar at Wheeling is *one* foot, open dams high enough to raise the water 5 feet above that surface, would afford a six feet navigation, whenever there was water enough to keep the water in the open channel, as high as the level of the dam. A continuous succession of dams of 5 feet lift, having the pools connected with each other by channels or open sluiceways 200

feet wide, if well supplied with water, would make an admirable navigation. The length of the pools would vary according to the natural declivity of the river. On the most rapid portion, between Pittsburgh and Wheeling, they would average seven miles each, and on the more gentle part, below Cincinnati, about 15 miles each. Between Pittsburgh and Evansville, a distance of nearly 800 miles, where the aggregate fall is 379 feet, it would take 75 dams, with pools averaging 10½ miles in length.

In regard to the water supply, it may be safely assumed, that if provision be made for keeping up a flow of 6 feet depth through the sluiceways on that part of the river between Pittsburgh and Wheeling, where the most rapid descent occurs, it will be ample at all points on the river, particularly at the lower end, where the fall is less than half as great per mile.

Compared with the plan of feeding the unobstructed river, what proportion of water will be needed?

Mr. Ellet shows, that to bring the water up from the low stage of one foot to a six feet stage, would require a daily supply of 1,062,000,000 cubic feet. Now, assuming that with 6 feet depth in the open dam, in a channel 200 feet wide, the pools being full, the average velocity for the entire prism may be three miles per hour, the quantity passing every 24 hours would be 456,192,000 cubic feet. Deduct the quantity passing in the low water depth of one foot, 102,000,000 cubic feet, and it leaves 354,190,000 cubic feet per day to be provided, which is but one-third of the quantity necessary on Mr. Ellet's plan.

At first view, this plan of a succession of dams, may appear to be merely a reproduction of the old system of wing dams, used to concentrate water into contracted channels. If the plan were only an *occasional* dam at a ripple, it would be the same principle; but with a regular continuous succession of dams, equal in the aggregate height to the entire fall of the river, it is entirely different, inasmuch as they serve to equalize the fall along the whole stream, and when properly supplied with water, all ripples will be entirely lost sight of. The only object of these dams is to save the expenditure of water.

We find from Mr. Ellet's tables, that 3 feet depth on the bar at Wheeling represents a flow of 400,000,000 cubic feet per day, which corresponds nearly enough for present comparison, with the assumed flow for a 6 feet depth in the sluiceways of the dam.

There can be no doubt that these sluiceways in a river like the Ohio, falling only one foot or less per mile, (averaging under six inches,) formed as suggested, will be easily navigable at any stage of water by ascending steamers and descending craft of every description, not drawing more water than the depth of the channel. Indeed, this plan can be carried out on rivers of even greater declivity. Col. S. H. Long, so well and so favorably known in the public service, in his Report to the Secretary of War, of Sept. 1, 1855, makes some pertinent remarks on this very topic. He says, "Sluice navigation is believed to be practicable, ascending as well as descending, under the following limitations, viz: the width and depth of the channel being sufficient to admit the free passage of a steamer, the ascent may be effected in all cases where the acclivity does not exceed 3 feet per mile. The improvement of the

rapids of the Mississippi is predicated on the feasibility of this postulate. * * * Letart's Falls on the Ohio and numerous other rapids above that point, are known to be navigable on terms less favorable than those above intimated. The Falls at Louisville have been ascended by steamers in medial stages of the river, when the acclivity was even greater than that above intimated."

Mr. Ellet, in his paper, remarks, "A descent of nearly 4 feet per mile is not incompatible with the existence of steamboat navigation, if the supply of water be well maintained; for a steamboat has ascended the Allegheny as far as Olean point; overcoming, in places, a slope of nearly 5 feet per mile."

Now, there is nothing so difficult as any of these, proposed in connexion with these low open dams. At the worst, there could scarcely be a velocity due to more than about two feet per mile fall, to overcome; less than is now daily encountered in the river at many of the ripples.

In Mr. Haupt's investigation of the flow of water, he bases his theory upon an isolated dam; which is different from a succession of dams, beginning at the upper end of the river where the fall is 12 inches per mile, and terminating at the lower end, with an average fall of less than 4 inches per mile. This succession, one dam backing the water against another, operates in two ways: in lessening the velocity of the flow through the sluiceways, and in greatly reducing the quantity of water necessary to keep up a six feet stage in the river. The difference is important, and the reason plain. In the case of an isolated dam, the water flowing freely through the sluiceways into the clear open river, meeting no obstruction, passes on with the velocity due to the declivity; whereas, in the case of a succession of dams, the same body of water which will fill the first pool, will also keep all the pools full.

The entire water of the pool will not move with the velocity due even to the middle portion, which is also retarded to a certain extent. It will present the aspect of a central current gliding through a larger body of comparatively still water. Thus, to express it roundly in figures, we may have a current two hundred feet in width passing at the rate of two miles an hour, whilst there may be 650 feet in width on each side, or 1300 feet in width, moving not over half a mile an hour. A portion, indeed, on the sides, may be back current or eddy water.

Again, if the same declivity of one foot per mile existed on the entire river, the same quantity of water would not quite fill the lower sluiceways of the series; but there are two constant causes obviating this, practically; one being the additional quantity of water entering the Ohio from its lower tributaries; the other its greatly decreased declivity.

These peculiarities in the natural regimen of the stream, may perhaps permit the use of wider sluiceways, and consequently shorter pieces of dams, as we descend the river. This seems to be a fair deduction. And furthermore, it is quite possible that the additional water required for the navigation on the upper portion of the Ohio, between Pittsburgh and Wheeling, on the plan of low open dams, may enable us to dispense with dams below Portsmouth. If not on that part of the river, at least below Louisville, where the declivity is but 2·8 inches per mile. It is expected that the government will soon finish the enlarged and improved

canal at Louisville; in that event, on the latter supposition, the remaining works to be built would all be above the Falls.

It is obvious, that every portion of the river below the lower dam, wherever that might be located, would be *improved* by reason of the additional quantity of water obtained from the artificial reservoirs. This remark will of course apply with still more force to Mr. Ellet's plan, on account of the larger quantity needed at the upper end of the river.

Plan and Cost of a Low Open Dam.

An open dam raising the water only 5 feet from pool to pool, would be very simple, and easily constructed. Some of the dams would be founded on rock, but most of them, probably, on gravel. On gravel foundations, the dam should be composed of a timber crib filled with stone, and sheet-piled on the up stream side. On good rock bottom, a substantial common rubble wall laid in cement should be built. The open space, 200 feet wide, might be covered with heavy paving, 18 inches thick, well clamped together, or, after the river had excavated the space several feet deep, it might be filled with a crib to the level of the bottom of the dam. A very cheap arrangement would ensure security at the shore ends of the dams, in all cases, as the water would not run over them until it was at nearly the same height from the back water of the next pool below. The ends of the dams adjoining the sluices, should be tapered from the height of the dam to the bottom of the sluice; presenting a channel about 225 feet wide at the top, and 175 feet at the bottom. Allowing the average width of the river at a 6 feet stage, to be even as great as 1800 feet, it would require but 1600 feet length of dam at each site, and for 400 feet total fall, 80 dams. My calculations give an estimated cost of about $35,000 for each, including two piers or beacons. The aggregate for the 80 dams is $2,800,000: adding 10 per cent. for the preliminary expenses, superintendence, &c., it makes a total of $3,080,000.

The effect of such low open dams upon the great floods of the Ohio, would be scarcely appreciable. It is not worth serious consideration, much less grave apprehension.

If it can be established beyond question, that this plan, as compared with Mr. Ellet's of keeping up the flow of the unobstructed river, may save two-thirds of the cost of the artificial reservoirs, that fact might lead to its adoption as an economical adjunct to the system of artificial reservoirs, in case they should be deemed preferable to locks and dams.

It is entitled to attention in another point of view, as it is quite evident that the low dams will increase the depth in the channels considerably, even without aid from reservoirs, though in the very lowest stages, they would be of no avail without such aid.

Mr. Haupt's analysis of the flow, founded on Mr. Ellet's paper, led him to the conclusion, that "whenever the quantity of water in the Ohio river would be sufficient to give a depth of 2 feet 8 inches on the bar at Wheeling, there would be sufficient to maintain *six feet* depth of water in an artificial channel 200 feet wide, flowing at the rate of 3·13 feet per second, or 2·1 miles per hour." This was based on its flow through the proposed river canal, running between the mound and the

shore, with an assumed fall of one foot per mile. On the modified plan, the pools being once filled, very little more would be required for the flow through the sluiceways, than would have sufficed for the canal.

Should it appear on future examination, that a complete system of artificial reservoirs on Mr. Ellet's plan, would cost $20,000,000 or more, supposing it to be fairly practicable and allowable, it is pretty clear that the adoption of this modification would effect a great saving. Thus, assuming one-third of $20,000,000 or $6,666,666 as the cost for reservoirs on the modified plan, and adding the approximate estimate of the cost of the 80 dams, would give a total of $9,746,667, and a saving of $10,253,333. These are all, of course, but approximations.

But even this comparison does not present fully the two plans. There are other facts derived from the records of the depths of water kept at Wheeling, of sufficient interest to be here introduced, which have a further bearing upon the question of adopting low open dams, as part of a reservoir system.

The following records of the different stages of water, contains some interesting facts, useful in the present investigation.

Records of Different Stages of Water Periods.

Lowest, or one foot stage.—The absolute lowest stage was in September, 1838, when for four days the water was but $\frac{7}{8}$ths of a foot. In the same year there were twelve days in September, and sixteen days in October, when it was at 1 foot. Total 32 days in 1838.

In 1839 it was not so low as 1 foot.

In 1840 it was at 1 foot in July for two days.

In 1841 it was at 1 foot in September for eleven days.

From 1842 to 1848 inclusive, it was not at 1 foot.

Thus, in eleven years it was as low as one foot for but forty-five days, or an average of four days per annum.

One and a half feet stage.—From 1838 to 1848, inclusive, it was never below $1\frac{1}{2}$ feet before July. In July, 1840, it was below $1\frac{1}{2}$ feet, but only for two days. During the eleven years, it was only eleven days (or one day per annum) below $1\frac{1}{2}$ feet as late as August. The whole number of days for the eleven years when it was below $1\frac{1}{2}$ feet, was 104, or an average of less than ten days per annum; and 66 days, or nearly two-thirds of it, occurred during the month of September.

In 1842, 43, 45, 46, 47, and 48, it was not below $1\frac{1}{2}$ feet. During 1838, for 45 successive days, it was below $1\frac{1}{2}$ feet.

Two feet stoge.—During the eleven years it was not below 2 feet before July, or after November.

The total number of days when it was below 2 feet was 188; an average of 17 days per annum; and 62 of them, or about one-third, occurred in one year, 1838: and 55 of them in 1841. There were two years, 1842 and 1845, when it did not fall below 2 feet. The greatest number in one year was 62 days.

Two and three-fourths feet stage.—During the eleven years it was not below $2\frac{3}{4}$ feet before May, or after November.

The total number of days when it was below $2\frac{3}{4}$ feet, was 509, or an average of 44 days per annum. There were 99 of the total number in 1838, and 85 in 1841. The least number was 14 days in 1847.

Three feet stage.—During the eleven years it was not below three feet before May, and only for a single day (1838,) after November.

The total number of days when it was below 3 feet was 609, or an average of about 55½ days per annum.

The greatest number was 109 days in 1841; next greatest 104 days in 1838; the least number was 15 days in 1847.

From the foregoing data it may be assumed for a *minimum*, that in each year the depth might be

As low as 1 foot, . .	30 days.
Between 1 and 1½ feet, .	15 "
" 1½ and 2 " .	17 "
" 2 and 2¾ " .	37 "
" 2¾ and 3 " .	10 "
	109 days in all, below 3 feet,

and that during the residue of the year, it will be at or above 3 feet, during which period it would need no artificial supply to maintain 6 feet depth in a 200 feet channel, on the low dam plan.

According to the tables, the natural flow for such season during the 109 days should be about as follows, 17,147,000,000 cubic feet.

The flow due to a 6 feet stage in the natural river for 109 days would be,	126,876,000,000	cubic feet.
From which deducting two-thirds would leave, ...	42,292,000,000	"
And deducting the natural flow,	17,147,000,000	"
Leaves,	25,145,000,000	"

to be supplied by artificial reservoirs for carrying out the plan with the low dams. This quantity might be obtained by three large reservoirs on the Allegheny, and one on the Monongahela. Or, as equivalent, by 54 reservoirs of the capacity of the Conemaugh reservoir; not including or allowing for any loss from evaporation in passing from the sources of the tributaries to Pittsburgh.

From the records and calculations of Mr. Ellet, it will be seen, that the quantity required to keep up the 6 feet stage in the natural river during these 109 days, was, after deducting the actual natural flow, 109,729,000,000 cubic feet. This is within a trifling fraction of *four times* the quantity required for the low dam plan. The reason why it is so much more is, that the ratio of *deficiency* per day is so much greater.

But this is not all: there are still *other days*, when no artificial supply would be needed on the low dam plan, in which the deficiency for the natural river would be very considerable. Thus, in one year (1845), there were 139 days when the water was at or below 4 feet depth. There were 190 days in 1841, when the water was at or below 5 feet, and 207 days when it was below 6 feet. Taking 1838, when the whole number was,

Below 4 feet, . .	133 days.
" 5 " .	161 "
" 6 " . .	164 "

In round numbers there were 24 days, river to be raised from 3 to 6

feet, 28 days from 4 to 6 feet, and 3 days from 5 to 6 feet; requiring 34,000,000,000 cubic feet to be added to 109,729,000,000 cubic feet, making an aggregate of 143,729,000,000 cubic feet of artificial supply. This would be nearly $5\frac{3}{4}$ times the quantity required on the plan of low dams. If the supply were dependent upon the small class reservoirs, it would require 308 reservoirs for the natural river. But if regulating reservoirs of large capacity should be deemed admissible on the main rivers, the number of small reservoirs would of course be diminished on either plan proportionally.

I proceed to the consideration of the system of locks and dams as proposed for the Ohio River, which the writer finds he is compelled to treat more elaborately than he at first imagined would be necessary, in consequence of the number of objections—some apparently of much weight—which have been brought to bear upon it. The public, particularly those who feel a lively interest in, and desire a proper settlement of, this question, are entitled to something beyond a simple contradiction of allegations, or the expression of a mere opinion respecting these objections. It will be the endeavor of the writer to consider every real objection which has come to his knowledge by experience or otherwise. It will be found that the investigation of the objections will constitute the chief argument in favor of the system.

Locks and Dams.

Slackwater navigation, consisting of locks and dams, is nothing new; but latterly many arguments have been made and numerous objections raised against the introduction of a similar system on the Ohio River. Mr. Haupt remarks in his pamphlet, before quoted, "The opinion is generally entertained that the plan of improvement by the construction of a slackwater navigation, is the only one practicable."

It may be, that this plan having been in use many years in various parts of the country, is more generally *understood;* but public opinion, even in Pittsburgh, a city which suffers more than any other from the irregularites of the navigation, has long been divided respecting the *mode* of improvement that ought to be adopted.

Many yet believe, that the plan of operations carried on for a time by the general government, under the superintendence of Major Sanders, had it been continued, would have answered the purpose; though at the most, he only expected to secure $2\frac{1}{2}$ feet in the channels in a dry season.

Experience has demonstrated, that there is not enough water to render the plan of loose stone wing dams and channel excavations successful, without large additional supplies of water from artificial reservoirs. Even a $2\frac{1}{2}$ feet navigation for several months of the year on this plan could not be obtained without a very heavy expenditure; and such a navigation would not answer the present, much less the prospective demands of commerce; whilst every year it would be more disproportioned to these demands.

A modification of Mr. Haupt's plan combined with Mr. Ellet's plan of artificial reservoirs, would be far superior in every respect. It has been already described and discussed in preceding pages. Neither of

these plans, namely, wing-dams, low dams and chutes, or artificial flow, as proposed by Mr. Ellet, can be perfected without the aid of reservoirs on a scale of considerable magnitude.

In regard to a system of locks and dams, or regular slackwater navigation on the Ohio, it is the firm conviction of the writer that no aid whatever is necessary from artificial reservoirs; and that future examinations will not only confirm this, but show, conclusively, that *at all times* there will be a considerable surplus of water, which may be used for hydraulic purposes.

The opponents of locks and dams assert, that there is not sufficient water for a slackwater navigation, without the aid of artificial reservoirs. This may be called their *first objection.*

To support this objection, but one fact has been presented, and that fact unaccompanied with an explanation which would have destroyed the erroneous impression it conveyed. That fact is, that the Monongahela slackwater in dry seasons is short of water sometimes, and that the Company contemplate the erection of reservoirs on the head waters, in order to make up the deficiency.

Admitting this to be true, let us follow it up with another fact. "In 1838, at the period of the lowest water known in the Monongahela, Allegheny, and Ohio Rivers for a great many years, the flow of water in the Monongahela above Pittsburgh was found to be in round numbers only 12,000 cubic feet per minute, whilst the flow in the Allegheny, as gauged by Major (then Captain) Sanders, was found to be in round numbers, 150,000 cubic feet per minute, or over 12 times the flow of the Monongahela." These rivers form the Ohio, at Pittsburgh, and the two contained at that time 13½ times the quantity shown in the Monongahela. The remarkable difference in the volume of water supplied by these two streams in dry seasons, is so striking and well known that it ought not to have been ignored.*

Now dam No. 1 on the Monongahela just above Pittsburgh is about 1300 feet long and 15 feet high. No greater height is contemplated on the Ohio; and how much greater will be the length of the dams? None of the opponents of slackwater navigation, would willingly estimate the length of each dam, exclusive of the space occupied by the abutment and double locks, at over 1560 feet, or one-fifth more than that on the Monongahela. It has been proposed to fix the height from pool to pool at not exceeding 8 feet; whereas, in dry seasons, on the Monongahela, the lift is 9 feet or more. What are the elements for comparison? We have seen that in an *excessively* dry time, such as occurs once in ten years, —there was at the head of the Ohio at the very commencement of the proposed slackwater, over *thirteen* times as much water as there then was in the Monongahela, its smaller tributary, and upon which has been in operation ever since, the most successful lock and dam navigation in the Union. Were the dams on the Ohio to be of the same height, the leakage and evaporation should be the same per foot of length of dam; but the Ohio dams are to be one-ninth less in height from pool to pool, and one-fifth longer. Whilst there will be one-fifth more length, there

*For some more recent measurements of the quantity of water in the Monogahela in a time of drought, see Appendix.

will be one-ninth less pressure upon every leak. So that practically, the total difference of leakage must necessarily be very trifling.

The number of cubic feet passing at the head of the Ohio, as gauged during the remarkably dry season of 1838, was 233,080,000 cubic feet per 24 hours. The writer has no certain means of determining whether the *average* for the driest month was more or less than this measurement. But we have some testimony which may be regarded as corroborative, from the records at Wheeling, and Mr. Ellet's calculations. On page 53 of his pamphlet he remarks, "But though the Ohio River never ceases to send water to the ocean, it will be seen by reference to note D, in the Appendix, that during *the memorable drought of* 1838, there was a period of 120 consecutive days when the depth on the bar at Wheeling was less than 5 feet. The actual average daily discharge during these 120 days, computed by the formula given in this paper, was about 220,000,000 cubic feet." We have no means of deciding whether the influx from the tributaries between Wheeling and Pittsburgh was greater or less than the evaporation at that particular period. The coincidence in the quantities represented, the one by actual measurements at Pittsburgh, in 1838, and the other by intelligent deductions from measurements in 1849, connected with the recorded depths of 1838, at Wheeling, is rather remarkable than otherwise. The difference being less than six per cent. of the larger quantity. But to make sure, suppose we take an extreme case, and allow only *one-half* of the *smaller* quantity as the basis of a summer daily supply! Would the opponents of slackwater demand harder terms?

Allowing the locks to be 350 feet long and 60 feet wide in the chamber, with 8 feet lift, the quantity for each lockage would be 168,000 cubic feet. Estimating a lockage every five minutes during the 24 hours, there would be 288 lockages, using 48,384,000 cubic feet, which, deducted from the assumed minimum 110,000,000, would leave 61,616,000 cubic feet to supply the *leakage* and *evaporation* of the first pool. This is more than 3½ times the entire flow of the Monongahela as gauged in 1838. And it would be considerably more than the leakage, soakage, and evaporation on 365 miles of the Erie Canal, including 100 lockages per day.

No civil engineer could stand justified in constructing a dam not over 1600 feet long, with no more than 8 feet lift, that should leak to an extent approaching such a body of water. Such leakage would, in *eight days*, exhaust the Conemaugh reservoir, constructed to supply the deficiencies of 104 miles of canal—with numerous dams of *much greater height*, for a whole summer!

Mr. Ellet also remarks, that "During six consecutive years, from 1843 to 1848, inclusive, there was but one month, August, 1843, when the average flow on the Wheeling bar was (a trifle) less than two feet depth, and but two other months, August, 1845, and September, 1848, when the average flow was less than 3 feet." And according to his calculations, with two feet on the bar, the flow was 228,000,000 cubic feet per day, more than double of our assumed basis; and with 3 feet on the bar, 400,000,000 cubic feet, or over 3½ times the same.

With these *facts* for our guidance, is it unreasonable to expect that notwithstanding the Monongahela Company may be forced to resort to artificial aid, the slackwater on the Ohio will be well supplied without any such arrangement? Surely it cannot cost the Monongahela Company much to obtain the little additional water they may need merely for slackwater purposes, if, according to the calculations of Mr. Morris, and Mr. Ellet, it will cost so little to furnish a constant flow of *not less* than 5 feet depth for the broad current of the unobstructed Ohio, flowing freely over its bed on a declivity of one foot per mile; and requiring 864,000,000 cubic feet per day, nearly *eight times* the quantity we have assumed to be *abundant* for the Ohio slackwater!

To controvert successfully, the opinion that there will always be an ample supply of water on the Ohio slackwater, should it ever be constructed, something more than a bare assertion to the contrary, with a mere reference to an inapplicable example, is looked for.

In the present state of the discussion, the writer thinks he will be sustained by the judgment of every candid examiner, in the opinion that this *first objection*, namely, want of water for the lock and dam system, has no reliable foundation. The question of water supply is a very important one, and we have endeavored in this case to put it to a severe test.

(To be Continued.)

For the Journal of the Franklin Institute.

On the Timber Bridges upon the Providence, Hartford, and Fishkill Railroad. By A. F. Wilder, Assistant Engineer.

The timber bridges of long span upon the line of this railroad, are constructed upon Howe's plan, with all the improvements, of which the following extract from the specifications will give a general idea:

"Bridges of less than 60 feet span only, have low trusses. The trusses of *open* and *rafter* bridges are 14 feet apart in clear, and 21 feet high; and of *deck* bridges of a height and distance apart adapted to their locality.

"The following general specification for a bridge of 120 feet span may be deemed a standard: bridges of other spans having at least equal strength. Trusses 21 feet high, 28 inches thick, and 14 feet apart. Panels from 10 to 11 feet long. Bottom chord, two pieces of $5\frac{1}{2}\times13$ inches, and two pieces of $6\frac{1}{2}\times13$ inches. Top chord two pieces of 6×10 inches, and one piece of 12×10 inches. Main braces, one half 8×10 inches, and one half 7×10 inches. Counter braces 7×8 inches. Floor beams, 6×13 inches, four to a panel, with an extra one under joints of track-string. Track-stringers equal in size to 11×12 inches; either single or in two pieces.

Bolts.—First set,	.	two of $1\frac{5}{8}$ inches,	and one of $1\frac{1}{4}$ inches.	
Second set,	.	" $1\frac{1}{2}$ "	" "	"
Third "	.	" $1\frac{1}{16}$ "		
Fourth and fifth set,		" $1\frac{1}{2}$ "		
Middle,	.	" $1\frac{5}{8}$ "		

"The timber is of the best western white pine, except the wall plates and bolsters, which are of white oak."

In some bridges the floor beams rest upon a false chord, properly supported from beneath, or suspended from above, at a varying distance between the top and bottom chord, depending upon the requirements of the different localities.

The low truss bridges have the trusses covered separately with side boarding and a tin roof, the flooring being left open. Larger bridges have the sides covered with clap boards secured to upright scantling. The ends are cased up, and the side boarding returns into the bridges from 10 to 15 feet at each end as a protection against driving-storms. On *deck* and *half-deck* bridges, the decking is so arranged as to admit the ordinary cross-tie, and obviate the necessity of having the rail spike pass through the tin.

These bridges were built by Messrs. Stone & Harris, of Springfield, Mass., under the direction of the chief engineer.

For bridges of short span, a form of truss has been adopted in many cases like that shown in Plate I. At Riverpoint, the centre line of railroad passes within a few rods of Dr. Harris's large cotton mills, where an embankment of earth or a stone viaduct would have seriously obstructed the light from the factories. A light timber structure was therefore erected, combining these two forms of construction, the roadway and the sluiceways from the factories being spanned by eleven trusses of 35 feet each in length, and the river by a Howe truss of 75 feet span in clear, making in all 467 feet for total length of viaduct, of which 82 feet are of Howe's truss, and 385 feet of the short truss (35 feet).

The general plan of construction for this bridge will be readily understood by reference to Plate I., in which a part only of the river span and three of the short spans are shown, each of which consists of four trusses, the two middle ones underneath the track-string—as will be seen by the specifications for timber—being somewhat heavier and stiffer than the outer ones. The trusses are supported by systems of three trestles resting on each pier, the middle trestle extending up to the track-stringer, and having four posts, the two outer ones being inclined. The outer trestles having two perpendicular posts only underneath the middle trusses, extending up to the lower chord. The track stringers rest immediately upon the thrust-pieces, and the rail lies upon the planking.

The piers are of peculiar form, built with economy of material for the purpose for which they were intended. The middle portion upon which all three trestles rest, is carried up of full thickness (5 feet,) from the foundation, while the ends, of 11 feet in length, are built with three offsets, leaving a width on top of only 22 inches, sufficient to receive the sill of the middle trestle.

This bridge was designed by S. Ashburner, Esq., Chief Engineer, and the details of construction were carried out under the direction of S. B. Cushing, Esq., Division Engineer. The scale of the full view is 20 feet to the inch or $\frac{1}{240}$; that of the section of trusses and view of trestle is 10 feet to the inch or $\frac{1}{120}$. The following bill of timber was used in

the construction of the 385 feet of short truss, amounting to 91,235 feet board measure, together with 17,700 feet 4 inch plank.

Specification of Timber for Trestle Bridge at River Point.

Number of sticks	Description.	Length.	Size in inches.
22	Upright posts, middle trestle of each set,	22 ft.	14×14
22	Inclined " " "	23 ft.	14×14
40	Upright " outer " "	16 ft. 9 in.	12×12
22	Caps, middle " "	15 ft. 6 in.	7×14
20	" outer " "	7 ft. 6 in.	8×12
22	Upper girders, middle " "	17 ft. 3 in.	8×12
22	Lower " " " "	22 ft.	6×12
11	Sills, " " "	29 ft. 6 in.	8×14
20	" outer " "	7 ft. 6 in.	8×12
22	Track stringers,	35 ft.	12×15
44	Outer "	35 ft.	3½×15
44	Corbels,	7 ft. 6 in.	10×12
2	Wall plates,	14 ft. 9 in.	6×12
	FOR TRUSSES.		
22	Inner thrust pieces,	16 ft. 3 in.	12×12
44	Outer " "	16 ft. 3 in.	3½×12
44	Inner braces,	10 ft. 6 in.	12×12
44	" "	8 ft. 9 in.	8×12
88	Outer "	10 ft. 6 in.	3½×12
88	" "	8 ft. 9 in.	3½× 8
22	Inner lower chords,	34 ft.	9×12
44	Outer "	34 ft.	3½× 9

¼ in. plank in lengths of 15 feet 3 inches, each. Widths not less than 10, nor more than 12 inches.

Bolts for each Span.

Main truss.	Outside truss.
4 of 1¼-inch.	4 of 1⅛-inch.
2 " 1⅛ "	2 " 1 "

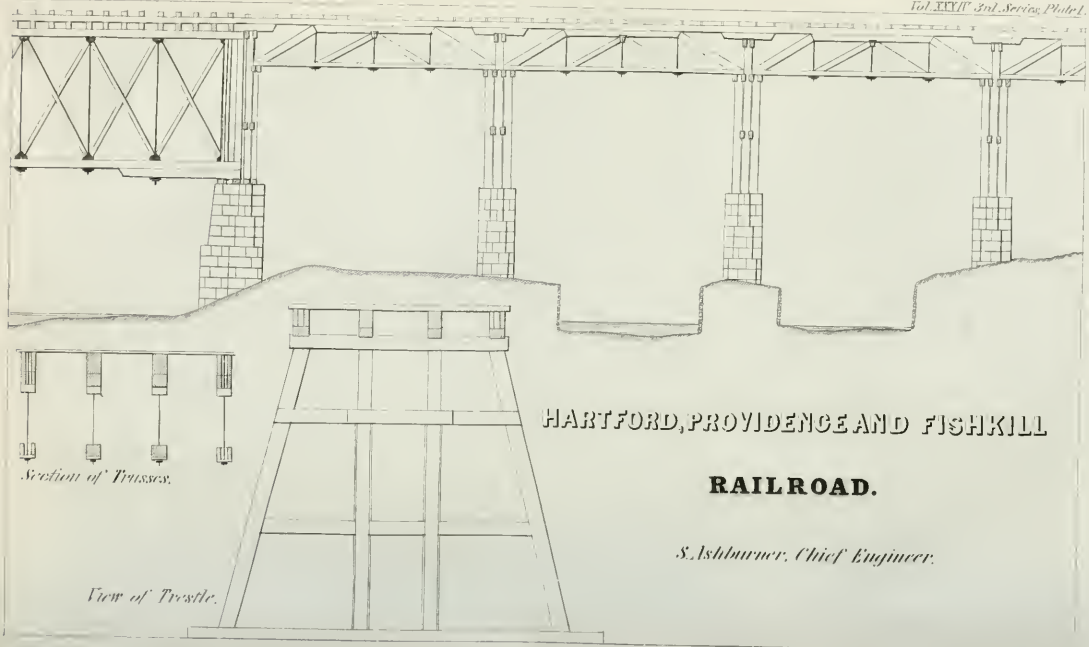
Bolts for caps, girders, and corbels, ¾-inch.

For the Journal of the Franklin Institute.

On the Submarine Telegraph. By A. C. Jones, Engineer.

The connexion of Europe with America by means of the "Ocean Telegraph," will soon be attempted by the laying of the telegraph cable, and if it fails, it most probably will be from the great strain on the wires during the first few miles, when the cable is suspended between the two sterns of the frigates.

Up to the present time, (and I have waited until I believe all the details have been published,) there has been no other precaution against this great strain and consequent stretching of the cable, than the making of about five miles of the wire, of steel instead of iron. This may or may not be sufficient to prevent a rupture of the small copper conducting wires, but it seems to me that where so much is at stake,


HARTFORD, PROVIDENCE AND FISHKILL
RAILROAD.
S. Ashburner, Chief Engineer.
Section of Trusses.
View of Trestle.

other precautions should be taken, and I will suggest one method which involves no ehange to the cable nor any delay in paying it out, and this is simply to attach *floats* to the cable by cords long enough to allow the cable to sink below the keels of vessels likely to cross its line before its final sinking.

The floats could be either kegs, bags of canvass made air-tight, "carboys," or demijohns well stoppered. To attach these to the cable, the following course should be pursued: a man stands at the "taftrail" on one side of the cable with a float in his hands, its lanyard (having a small hook at its end,) leading to another man near the cable, he passes the end around it, and hooks it to its own part, (making a running bow line,) keeping it loose so that the cable runs through it until the allotted space is reached; a slight pull jambs the cord on the cable, and the float passes from the man holding it to the surface of the sea. On the other side of the cable, two men similarly situated, act in the same manner, and thus a float passes alternately from each side of the cable without confusion or delay.

The cable having the floats to support it at points from the middle, will sink to the length of the float lines, forming a series of undulations, which will produce an elasticity and neutralize the strain on the cable by the pulling of the steamers, and the buoyancy of the floats will relieve it of other strain.

After a sufficient length, commensurate with the depth of the water, has been floated, the floats there may be attached at greater distances apart until no more are required; the effect will now be that the floats not being sufficient to support the eable it *gradually* sinks, and one after the other of the floats are dragged under, until all of the floated portion slowly reaches the bottom of the sea, and then the floats will either become ruptured or filled by the pressure of the column of water.

I was once a witness of a long seine which had been improperly weighted, act in the precise manner which I have pointed out the cable would do, and I give the suggestion to those interested to adopt or not.

For the Journal of the Franklin Institute.

Railroad Developments. By John M. Richardson, B. S.

The maximum grade of any road is determined by the following considerations, viz: the character and amount of the traffic it is required to accommodate, the topography of the country through which it passes, and the funds at the disposal of the company. "What a road ought to be," is determined by the first of the above considerations, but the second and third, frequently, if not always, interfere and determine that it must be what it should not be.* Owing to the great irregularity of the surface of the earth, the ingenuity of the superintending engineer is often severely taxed in endeavoring to keep within the limits of the required grade, and very frequently much valuable time is lost. I propose to present in this paper, some considerations which should influence an engineer when seeking to locate a road between two points, the direct

* See note 1, page 167.

line connecting them being too short. This is a case of frequent occurrence in hilly and mountainous districts, and one which often causes much difficulty. Imagine a case. Suppose it is required to connect two points A and B, whose difference of level is six hundred and sixty (660) feet, their horizontal distance apart ten (10) miles, and the maximum grade forty (40) feet per mile. It is evident that the straight line connecting A and B is too short and steep, for it rises sixty-six (66) feet per mile. Hence the line cannot be straight, but must be curved or mixed. Regard A as the lowest of the points; a little consideration will show that in order to get the shortest line fulfilling the required conditions, it must continue to ascend according to the given grade. Now, $660 \div 40 = 16{\cdot}5$; that is, the horizontal length of the required road is 16·5 miles. If from the nature of the surface between A and B any part of the road connecting them be necessarily level, the entire horizontal length will be 16·5 miles + the level part. If the road any where descends below the regular grade line in passing from A to B, the entire horizontal length will be 16·5 + a length equal to that necessary to overcome a height twice that of the descent. If the road any where ascends above the regular grade line in passing from A to B, the entire horizontal length will be generally equal to at least 16·5 miles + a length equal to that necessary to overcome a height twice as great as the ascent. Thus, if in passing from A to B, the line any where descends one hundred (100) feet below the grade line it will have to ascend the same, and this ascent and descent of an extra one hundred feet will be equivalent to adding at least two hundred (200) feet to the original difference of level; making it eight hundred and sixty (860) feet, and increasing thereby the horizontal length of road by at least five (5) miles. Cases may arise in which it will be impossible to avoid making occasionally such descents and ascents in passing from A to B, but such a location should be given to the road, if it is possible to find one not attended by too great cost, that the ascent from A to B may be gradual and constant.*

If d denote the sum of the unavoidable descents below the grade line in passing from A to B, a, the sum of the unavoidable ascents above the grade line, l, the length of level part, the entire horizontal length of road connecting A and B, will be generally, at least

$$16{\cdot}5 + 0{\cdot}05\,(a + d) + l \text{ miles.}$$

And the length of the road itself,

$$l + \left[\left(\frac{330 + a + d}{2040}\right)^2 + 0{\cdot}0025\,(330 + a + d)^2\right]^{\frac{1}{2}} \text{ miles.}$$

If $a = d = l = o$, the length of the shortest line will be, 16·500173 miles.

Now, although this is the *shortest* line fulfilling the required condition, it may assume *several different positions;* it may lie entirely on one side of the vertical plane, passing through A and B; or, partly on one side and partly on the other; or it may assume several different positions on the same side.† Some of these positions or locations, will now be traced and others indicated.

PROBLEM.—Having given the difference of level of two points A and B, and their horizontal distance apart, it is required to connect them by

* See note 2, page 167. † See note 3, page 168.

a line rising uniformly from A to B according to an assumed grade—that is, by a line making a constant angle with the horizon. Let the horizontal plane of reference pass through A, and B′ be the projection of B on that plane; h = height of B above A, and $2\,c$ = their horizontal distance apart.

Since the required line is to make a constant angle with the horizon, it must be a helix, and if a denote the constant angle, the length of helix is,

$$z = h \operatorname{cosec} a. \qquad (1)$$

The horizontal projection of z, or horizontal length of line connecting A and B, is,

$$s = z \cos a = h \cot a, \qquad (2)$$

The *length* of a helix as well as the length of its horizontal projection, is unaffected by the nature of the surface upon which it is located, but the *position* of the helix in space, and the form as well as position of the curve into which it is projected, depend entirely upon the nature of this surface. (See article on "Helices and Helicoidal Surfaces," in *Journal of the Franklin Institute*, vol. xxxiii, page 231.)

For the sake of simplicity assume that the helix is located on a right cylinder with circular base, whose projection on the plane of reference passes through A and B′, and that the helix shall not pierce the vertical plane of A and B. The projection of the helix, which will be the horizontal length of the required line, and which is known from difference of level of A and B, and the assumed grade, will be the arc of a circle passing through A and B. The problem will be solved when the radius of this arc and the angle subtended by it are determined.

Fig. 1.

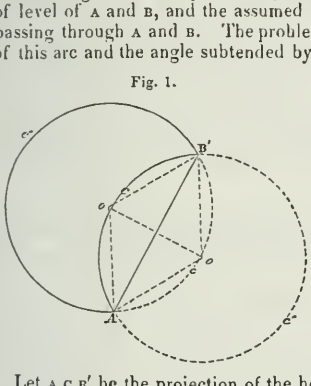
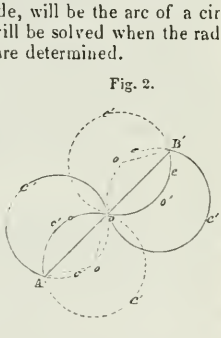


Fig. 2.



Let A C B′ be the projection of the helix: ρ = O A the required radius, $2\,\phi$ the angle subtended by A C B′. The equations of condition are,

$$\rho\, 2\,\phi = s = h \cot a, \qquad (3)$$

$$\rho \sin \phi = c, \qquad (4)$$

Expanding $\sin \phi$ in terms of ϕ,

$$\sin \phi = \phi - 2^{-1}.\, 3^{-1}.\, \phi^3 + 2^{-1}.\, 3^{-1}.\, 4^{-1}.\, 5^{-1} \phi^5 - 2^{-1}.\, 3^{-1}.\, 4^{-1}.\, 5^{-1}.\, 6^{-1}.\, 7^{-1}.\, \phi^7. + \&c.,$$

Substituting in 4,

$$\rho\,(\phi - 2^{-1}.\, 3^{-1}.\, \phi^3 + 2^{-1}.\, 3^{-1}.\, 4^{-1}.\, 5^{-1}.\, \phi^5 - 2^{-1}.\, 3^{-1}.\, 4^{-1}.\, 5^{-1}.\, 6^{-1}.\, 7^{-1}.\, \phi^7 + \&c.) = c, \qquad (5)$$

Eliminating ρ between (3) and (5), and taking only these terms of the development of $\sin \phi$,

$$\phi^4 - 20\,\phi^2 = 240\,c\,h^{-1} \tan a - 120, \qquad . \qquad (6)$$

Solving (6),

$$\phi = \pm\,[10 \pm (240\,c\,h^{-1} \tan a - 20)^{\frac{1}{2}}]^{\frac{1}{2}}, \qquad (7)$$

Substituting in (4) and reducing,

$$\rho = d \operatorname{cosec} [10 \pm (240\,c\,h^{-1} \tan a - 20)^{\frac{1}{2}}]^{\frac{1}{2}}, \quad . \qquad (8)$$

From (7), it is evident that ϕ will have at least two real values, numerically equal, but affected with contrary signs, when,

$$\tan \overline{\overline{>}}\; 6^{-1}\,(2\,c)^{-1}\,h, \qquad . \qquad . \qquad (9)$$

If a' be the angle made by the straight line connecting A and B with A B', $\tan a' = (2\,c)^{-1}\,h$, and (g) becomes,

$$\tan a \overline{\overline{>}}\; 6^{-1} \tan a', \qquad . \qquad . \qquad (10)$$

If in addition to the condition expressed by (10) there is this other one, viz:

$$10 \overline{\overline{>}}\; (240\,c\,h^{-1} \tan a - 20)^{\frac{1}{2}}, \text{ or reducing,}$$

$$\tan a \overline{\overline{<}} \tan a' \qquad (11)$$

ϕ will have four values, of which, however, only two will differ numerically.

It is evident from the nature of the problem and the conditions assumed, that $\tan a$ can never exceed $\tan a'$; also that the two values of ϕ which differ numerically, must be supplements to each other, *i. e.*, so related that their sines will be equal; for if they are not, ρ will have two different values, numerically considered, and therefore s, the projection of the helix, will be equal in length to arcs of two different circles subtended by a common chord; which is impossible. (See Davies' Legendre, Bk. v., P. 17.)

Again, since the relation expressed by (11) must always hold, that expressed by (10) must also, in order for ϕ to be real. The assumed condition which determines (10) is, that the helix shall not pierce the vertical plane passing through A and B.

If $\phi < 45°$, the helix will be projected into an arc less than a semicircle; if $\phi = 45°$ the projection of the helix will be a semicircle; and if $\phi > 45°$, the arc of projection will be greater than a semicircle. Having found ρ and ϕ, the arcs can be traced and the difficulties to be encountered, in constructing the road along either of them, ascertained. Several other routes may also be obtained. A B' may be divided into 2, 3, 4, or more parts, equal or unequal, and the helix located on as many tangent cylinders. The projection of the helix in all such cases will be a curve of contrary flexure. (See fig. 2.)

It is seen that ϕ and ρ can only be approximately determined, the nearness of the approximation depending upon the number of terms of the development of $\sin \phi$ that is taken. If 4, 5, 6, &c., be employed, equations of the 6th, 8th, 10th, &c. degrees, will be obtained; but as they contain only even powers of ϕ, they may be reduced to equations of the 3d, 4th, 5th, &c. degrees, by introducing an auxiliary unknown

quantity. Instead, however, of attempting to solve those equations, it will be better perhaps, to proceed thus :—Having found an approximate value of ϕ from (7), (8) will give an approximate value of ρ—$\rho=r'$—. Substituting in (3) there will result

$$\phi=2^{-1}\, r^{-1}\, h \cot a=\phi' \qquad . \qquad . \qquad (12)$$

This in (4) gives

$$\rho=c \operatorname{cosec} \phi'=r'' \qquad . \qquad . \qquad (13)$$

This in (3) gives

$$\phi=2^{-1}\, r''^{-1}\, h \cot a=\phi'' \qquad . \qquad . \qquad (14)$$

This in (4) gives

$$\rho=c \operatorname{cosec} \phi''=r''' \qquad . \qquad . \qquad (15)$$

&c. &c. &c.

The approximation should be continued in this manner, until ρ is correctly obtained to four decimal places. If, in any case, $\tan a < 6^{-1} \tan a'$, the helix cannot be located on a right cylinder with circular base, and must then be traced on some other surface or surfaces. (See article "Helices," &c., already referred to.) Since (7) gives only an approximate value for ϕ, the two values of ϕ will not be exact supplements of each, but will only approximate towards that relation, and will approach nearer and nearer to the state of having their sines equal to each other the farther the approximation is carried. The same remark holds, when, instead of employing (7) to find ϕ, 4, 5, 6, &c. terms of the development of $\sin \phi$ are used.

When equations of higher degrees than these are employed to determine ϕ, the real and positive values obtained must either be supplements of each other, or so related that their sines are equal.

$$\sin \phi=\sin (\pi-\phi)=\sin (\pi+\phi)=\sin (2\pi-\phi)=\sin (2\pi+\phi)= \sin (m\pi\mp\phi) \qquad . \qquad . \qquad (16)$$

m must be a positive even number. The values equated are the numerical ones, no attention being paid to the algebraic signs.

If four (4) terms of the development of $\sin \phi$ be employed the resulting equation in ϕ will be

$$\phi^6-42\, \phi^4+840\, \phi^2=5040-10080\, c\, h^{-1} \tan a \qquad . \qquad (17)$$

Putting $x=\phi^2$, (14) becomes

$$x^3-42x^2+84x=5040-10080\, c\, h^{-1} \tan a \qquad . \qquad (18)$$

If five (5) terms be employed the resulting equation will be

$$\phi^8-72\phi^6+3024\, \phi^4-60480\, \phi^2=725760\, c\, h^{-1} \tan a-362880 \qquad (19)$$

(19) may be put under the form

$$x^4-72x^3+3024x^2-60480x=725760\, c\, h^{-1} \tan a-362880 \qquad (20)$$

Having found an approximate value for x from (19) or (20), there will result $\phi=\mp\sqrt{x}$. This in (4) will give an approximate value for ρ. Then apply the method of approximation already described.*

The helix may be located on several tangent cylinders, so that its

* See note 4, page 168.

projection may be a curve of contra-flexure, lying entirely on one side of A B′. Several examples are given. (See figs. 3, 4, 5.)

Fig. 3.

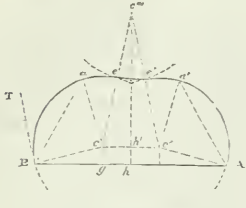


Fig. 4.

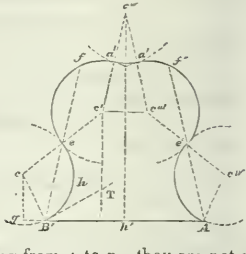
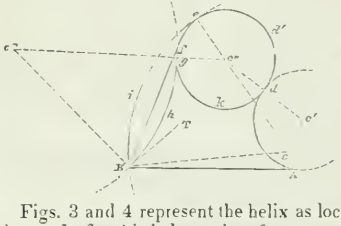


Figure 5 exhibits six routes for passing from A to B—they are not all of the same length in the diagram—A $d\,d'\,e\,i$ B′; A $d\,d'\,e\,f$ B′; A $d\,d'\,e\,f\,g\,h$ B′; A $d\,k\,g\,h$ B′; A $d\,k\,g\,f\,e\,i$ B′. Now although, in practice, none of these may ever arise, especially none of the last three, yet it is easy to conceive of the circumstances under which it may be necessary to adopt any one of them.

Fig. 5.



Figs. 3 and 4 represent the helix as located on three (3) tangent cylinders. In fig. 4 it is located on four.

In fig. 3 $ed = ee' = e'\,d' = 3^{-1}\,d$B′ $= 3^{-1}$A$d' =$ one-ninth of the entire horizontal development $c\,d = c'\,d' = c''\,e$. B′ d is an assumed chord taken sufficiently long to prevent too great curvature in the arc B′ d. Having determined $\rho = c\,d = r$, and $\phi =$ B′ $c\,d =$ B, the horizontal development can be traced. In order to trace it, the angle which the curve at its initial point makes with A B′, must be found. Drawing B′ T tangent to the curve at B′, it makes with A B′ an angle.

$$\text{A B}'\,\text{T} = \text{A B}'\,c + c\,\text{B}'\,\text{T} = \text{A B}'\,c + 90^\circ, \qquad (21)$$

Draw $e\,g$ perpendicular to A B′ and $c\,h'$ parallel to the same; thence $c\,h' = h\,g = 2\,c\,e \sin(6^{-1}\,\phi) = 2\,r \sin(6^{-1}\,\phi)$;
B′ $g = 2^{-1}\,c - 2\,r \sin(6^{-1}\,\phi)$; and $\cos$ A B′ $c = 2^{-1}\,c\,r^{-1} - 2 \sin(6^{-1}, \phi)$ or,

$$\text{A B}'\,c = \cos^{-1}\left[2^{-1}\,c\,r^{-1} - 2 \sin(6^{-1}\,\phi)\right] \qquad (22)$$

In fig. 4, $df = d\,d' = d\,f' = 3^{-1}\,e\,h$ B′, and since,
B′ $e = e\,f = f''\,e' = e'$ A there results

$$\text{A B}'\,\text{T} = \text{B}\,c\,g = f\,c'\,d = 3^{-1}\,\text{B}'\,c\,e = 3^{-1}\,\phi \qquad (23)$$

If in fig. 5, the development A $d\,d'\,e\,f\,g\,h$ B′ be taken, the angle A B′T can be determined thus: In the plane figure A B′ $c'''\,c''\,c'$ all of the sides

are known together with the angles $B' c''' c''$, $c''' c'' c'$ and $c'' c'$ A. Hence, $AB' c'''$ can be found, and subtracting 90° from it, the remainder will be equal to A B′ T. That is,

$$AB'T = AB'c''' - 90^\circ, \quad . \quad . \quad (24)$$

The angle made by the tangent to $e\,i$ B′ at B′, is also readily found—likewise the angle made by f B′ with A B′. In all cases except the first ρ may be assumed so as to regulate the curvature of the arcs. ϕ and the chord will then be known.

Figs. 3, 4, and 5, have been introduced merely to show into what a variety of forms the helix may be projected.

The practical conclusion drawn from this investigation is as follows: when it is required to connect two points whose horizontal distance apart and difference of level are given, by a line making a constant angle with the horizon, the straight line connecting the points being too steep, the shortest line fulfilling the condition, may assume many different positions, several of which should be examined in detail, and that one selected which presents the fewest, or least formidable obstacles to the construction of the road. Much might be added here with regard to the importance of running numerous "trial lines," when the nature of the surface is such as present any difficulty in the practical solution of the problem. I forbear, however, to say more than I have already said on this subject. Any additional remarks may seem to be rather out of place in this paper, which is devoted to the solution of a special problem in practical engineering.

NOTES.

[1.] For an excellent *resumé* of the principles which should determine the construction of a road, see chapters i and v of Prof. Gillespie's work, "A Manual of Road-making." This work cannot be too highly commended. It is admirably suited for an introductory text book to the professional student, and although it does not go so fully into the matter as such a reader may desire, it is the better calculated to answer the purpose intended by the author, whose aim was to diffuse practical information in a popular form adapted to the capacity of the general class of readers and students.

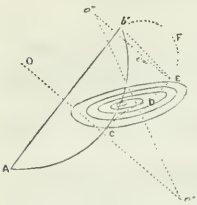
[2.] See Prof. Gillespie's work already referred to, page 233. It seems to be hardly necessary to add any thing to the preceding remarks, but lest any one should experience the least difficulty in comprehending how it is that a descent below, or an ascent above, the grade line can add, practically, to the difference of level between the two points, a height equal to twice the ascent or descent, an example will be given.

Referring to the example already suggested in the body of this paper, if in passing from A to B, three hundred (300) feet of their difference of level being overcome by a line rising uniformly from A to B, accordingly to the required grade, it being found necessary owing to the great irregularity of the surface, a valley intervening for instance, to descend one hundred (100) feet, a corresponding ascent will have to be made before the original difference of level, (360) feet, between B, and that point of the road where the descent began, can be restored. And this descent and ascent of an extra one hundred (100) feet will require a length of road equal to an ascent or descent of two hundred (200) feet; and the total length of road will be the same as if two hundred feet had been added to the difference of level of A and B, and the road had risen continuously according to the assumed grade from A to B.

Again, if after having overcome three hundred (300) feet of the difference of level between A and B, it be found necessary—a mountain intervening which it is judged best not to pierce by a tunnel—to ascend above the regular grade line to a height equal to one hundred (100) feet, the difference of level between B and the point where this ascent terminates, will be less by one hundred feet than the difference of level between B and the point where the ascent above the grade line began. Hence, only two hundred and

sixty (260) feet remain to be overcome, and if no corresponding descent be necessary, and if the horizontal distance from B to the point where the ascent began, be not increased, the total length of road from A to B may not be increased at all. But if, as will generally be the case under such circumstances, a corresponding descent of one hundred (100) feet be necessary before the surface of the ground is such that the road can ascend continuously from A to B, the total increase in length of road connecting A and B will be equal to that necessary to overcome a height of two hundred (200) feet, as already determined. It will be well to illustrate this last position by fig. 6.

Fig. 6.



Let A C B′ be the projection of the regular grade line as located on the surface of a right cylinder with circular base, and whose base passes through A and B′, C is three hundred (300) feet above A, and suppose that after having arrived at C, the superintending engineer concludes that it is best not to pierce the mountain intervening between C and B by a tunnel, but to deflect the road to the right rising above C one hundred feet to D. It will generally be necessary to descend at least one hundred (100) feet to some point as E, before the surface of the ground is such that the road can ascend continuously to B. This ascent and descent of one hundred (100) feet, will add five miles to the length of road connecting A and B, and it will, in general, be preferable to pierce the mountain and build the road along the line A C B′, rather than along the line A C D E F B′; but if the initial expense of constructing the road along the route C D E F B′, the yearly expense of keeping it in repair, and the wear and tear of the engines and cars over the same, be less than the aggregate of the corresponding items of expense along the line C B′, the engineer will be justifiable in making the deflection; otherwise he will not.

Further, if the difference of level between the highest point of road and A be greater than the difference of level between A and B, then the length of road connecting A and B, will be increased by an amount equal to at least that much necessary to overcome a height twice as great as difference of level between B and the highest point of road.

—

[3.] The line is evidently a helix, and it may be located upon a cylinder, a cone, a sphere, an ellipsoid, a paraboloid and a hyperboloid—or it may be traced upon several tangent surfaces—and in no two cases will the projections be the same, although they will all be of the same length.

—

[4.] Let $h = 660$ feet; $2c = 52{,}800$ feet; $\tan a = 1 \div 132$, which corresponds to a grade of forty (40) feet per mile.

$$\tan a' = 660 \div 52{,}800 = 1 \div 80 = \cdot 0125.$$

Hence $\tan a > 6^{-1} \tan a$.

Substituting in (7),

$$\phi = 1\cdot 654, \text{ or } 4\cdot 164.$$

To express ϕ in seconds.

$$\phi = 648{,}000 \times 1\cdot 654 \div 3\cdot 14159 = 341130\cdot 4',$$

and reducing to degrees, minutes, and seconds,

$$\phi = 94^\circ, 45', 30\cdot 4''.$$

This value in (4) will give the first approximate valve of ρ. Substituting it in (3), the second approximate value of ϕ will be obtained. And so on, placing in (15), for c, h, and $\tan a$, their values then results,

$$x^3 - 42x + 810x = 21{,}840 \div 11.$$

By inspection $x > 2$ and < 3.

Assume $x = 2\cdot 6$, there results,

$$x = 2\cdot 4944 : \text{ and } \phi = \sqrt{x} = 1\cdot 57,$$

for the first approximate value of ϕ, which can be employed as before.

The higher the degree of the equation employed, the more nearly correct is the value obtained for ϕ.

It is evident, that ρ is always greater than c.

Hence, instead of solving 7, 15, or 18, an approximate value for ρ greater than c may be assumed, and the method of approximation then applied to find ϕ and ρ correctly to four or five decimal places. It will be best, however, to solve one of the highest equations involving ϕ.

A word of explanation here, with regard to fractional and negative exponents. It is possible that this paper may fall into the hands of some whose limited mathematical knowledge will not enable them to comprehend the analytical solution of the problem, but who may be desirous to apply the results of the investigation. For the benefit of such, the following equivalent expressions are given:

$$a^{2/3} = \sqrt[3]{a^2} : (a^2-b^2)^{1/2} = \sqrt{a^2-b^2} : 6^{1/2} = \sqrt{6} : (63-48)^{\frac{2}{3}} = \sqrt[5]{(63-48)^2}$$

And generally,

$$a^{\frac{m}{n}} (r^2-s^3)^{\frac{p}{q}} = \sqrt[n]{a^m} \times \sqrt[q]{(r^2-s^3)^p}.$$

That is, any quantity raised to a power denoted by a fractional exponent, is equal to that root of the quantity whose index is the denominator raised to a power, the exponent of which is the numerator.

$$2 \cdot 7^{-1} = 2 \div 7 : 3 \cdot 4^{-3} = 3 \div 4^3 : 7 \cdot 9^{-1/2} = 7 \div 9^{1/2} = 7 \div \sqrt[3]{9} :$$

$$(6a + 7^{-1} b)^{-2/3} = 1 \div (6a + b \div 7)^{2/3} = 1 \div \sqrt[3]{(6a + b \div 7)^2}.$$

And generally,

$$a^{-m} b^{-n} c^{-s} d e = d e \div a^m b^n c^s.$$

That is, if there be several factors, some of which have negative exponents, the expression is equivalent to a fraction whose numeration is the continued product of the factors having positive exponents, and denominator the continued product of the factors having negative exponents, the signs of the negative exponents being changed.

AMERICAN PATENTS.

List of American Patents which issued from June 2d, to June 23d, 1857, *(inclusive,) with Exemplifications.*

JUNE 2.

1. For an *Improved Door Lock;* Thomas B. Atterbury, Pittsburgh, Penna.

Claim.—"1st, The use of the vibrating arm, which, whilst it acts as a tumbler to the bolt, serves, in combination with the follower, as a means of disconnecting the spindle from the bolt when the door is locked, and connecting them when unlocked. 2d, The use of an arm or lever, which, when pressing upon the tumbler of the lock, prevents its being raised, thus forming a guard which protects the locking bolt from any action of the key, and prevents the locking or unlocking of the bolt."

2. For an *Improvement in Sleeve Fasteners;* William A. Bates, Boston, Mass.

Claim.—"My improved bracelet clasp made with a slotted tongue and catch-hook, and with its body to spring lengthwise."

3. For an *Improvement in Skates;* R. W. Belson, Philadelphia, Pennsylvania.

Claim.—"Constructing the skate entirely of cast metal, and of two parts connected together."

4. For an *Improved Hydrant;* Wm. W. Binny, Seneca Falls, New York.

Claim.—"The pipe, fitted within the case and within the tube or neck: the pipe having a flanch or collar upon it above the neck, and provided with a valve at its perforated lower end, said pipe being fitted within the neck or tube, and used in connexion with the box or chest, and spring."

5. For an *Improvement in Fastenings for Garments;* Jeremy W. Bliss, Hartford, Connecticut.

Claim.—"The new manufacture of fastening for garments, to wit: a plain or ornamental plate or bar, having sharp hooks permanently fastened to it, pointing towards each other or towards the centre, so arranged as to be conveniently hooked into the garments to be fastened or unhooked therefrom."

6. For an *Improvement in Mowing Machines;* Silas P. Briggs, Saratoga Springs, New York.

Claim.—"The peculiarly constructed attachment, when connected to, and used in, combination with the Ketchum mowing machine."

7. For an *Improvement in Printing Presses;* Jason L. Burdick, City of N. York.

Claim.—"1st, The arrangement of working the roller upon which the type is attached, in such a manner as to communicate to the same a forward and backward motion in connexion with a rotating motion. 2d, The arrangement of a guide piece for the purpose of guiding the type roller in the latter part of its forward motion, so as to bring the types always square against the platen containing the paper or card to be printed."

8. For an *Improved Door Hinge;* S. M. Bullard, Holliston, Massachusetts.

Claim.—"The detached anti-friction roller, inserted between two inclined planes."

9. For an *Improvement in Machines for Preparing the Fibre of Banana, Plantain, Aloe, &c.;* Francis Burke, British West Indies; patented in England July 14, 1855.

Claim.—"The combination of the beating cylinder with the endless apron and yielding table or surface under the apron."

10. For an *Improvement in Method of Hanging Mill Stones;* Wm. A. Clark, Samuel D. Porter, and Wm. D. Simpson, St. Louis, Missouri.

Claim.—"Suspending the upper stone from above by means of a ball and socket-joint (or its equivalent), when the eye of the said stone is made to embrace the upper portion of the spindle of the running stone, and is secured thereto with a sufficient degree of rigidity by means of an elastic packing."

11. For an *Improvement in Packing Pistons and Stuffing Boxes of Steam Engines;* Patrick Clark, Rahway, New Jersey.

Claim.—"The foil or plastic sheet metal packing."

12. For an *Improvement in Steam Pumping Apparatus;* George H. Corliss, Providence, Rhode Island.

Claim.—"The arrangement of a series of steam cylinders and pumps, combined radially around a central crank shaft with a central crank and crank shaft, with which the whole series of pumps and steam cylinders are connected. 2d, The method of forming the connexion between the pistons of a series of cylinders, and a single crank pin, by means of a disk ended connecting rod, and which is appropriated to one piston in the series, and which is fitted with a series of pins to which the remaining connecting rods of the series of cylinders are applied, thus obviating the direct application of all the connecting rods in the series to the same crank pin."

13. For an *Improved Lock;* Julius M. Cook, Hinsdale, Pennsylvania.

Claim.—"The set, arranged and operating in connexion with the wheels, fly, and shaft."

14. For an *Improved Water-Wheel;* Reuben Daniels, Woodstock, Vermont.

Claim.—"The use of the flanch, or its equivalent."

15. For an *Improvement in Sewing Machines;* James E. A. Gibbs, Millpoint, Va.

Claim.—"The revolving hook constructed and arranged in relation to, and operating in connexion with, the needle. Also, when sewing with a single thread, interlacing or twisting the threads of the loop after passing the cloth to be sewed, and before taking a fresh loop."

16. For an *Improvement in Potato Diggers;* Isaac Griffen, Quaker Springs, N. Y.

Claim.—"The arrangement of the drag, axle, and swinging fork."

17. For an *Improvement in Ploughs;* John S. Hall, West Manchester, Pennsylvania.

Claim.—"Vibrating the beam in a circular bearing in the land side, together with the oblique adjusting and securing slots, whereby the draft end of the beam may be vertically adjusted, and the beam so secured to the land side as that it is impossible for the former to slip."

18. For an *Improved Block for Blacking Boots and Shoes;* Francis G. Harding, Boston, Massachusetts.

Claim.—"The new article of manufacture consisting of the thin metallic shells, hinged at the former, having an extension to serve as a handle to the implement, and fitting the front inside of the shoe, and the latter fitting the inside of the heel, the said shells being distended, and the shoe thereby firmly held by means of the screw passing through the shell, and abutting against the projection of the shell."

19. For *Improved Gauge Attachments for Hand Saws;* Michael Kennedy, Troy, New York.

Claim.—"Making the gauge for regulating the depth of the saw-cut with adjustable clamps which are formed to fit and gripe the saw-back, and are attached to the arms of the gauge independently of the set-screws by which the clamps are fastened to the saw-back, so that the gauge cannot only be fastened at any desired place upon the blade, without requiring the blade or the saw-back to be perforated, but so that the gauge can also be removed from and replaced upon the saw, without altering the set of the gauge, and so that the gauge can be adjusted upon the blade without loosening the clamps which hold the gauge to the saw."

20. For an *Improved Faucet;* Lucius J. Knowles, Warren, Massachusetts.

Claim.—"Combining with or arranging with respect to the valve stem and eduction passage of the body of the faucet, the secondary chamber or drip passage. Also, arranging an annular groove in that part of the valve stem which slides in and out of the recess of the body of the faucet."

21. For an *Improvement in Life Preservers;* James Knight, City of New York.

Claim.—"The construction of the supporter to sustain the head in the position assumed by persons when swimming, thus releasing the wearer from muscular effort, and attached to this supporter a shield to protect the mouth and nostrils from the violence of the waves, and this supporter and shield fitted to the ordinary life preservers as worn round the body, by having attached to them sheaths, one of them fitted with a sheath to admit the stem of the supporter for adjustment to the wearer; the whole when combined constitutes my improvement."

22. For an *Improvement in Feeding Gas Generators;* C. B. Loveless, Syracuse, New York.

Claim.—"The connexion of the feeder with the retort by the arrangement of pipes, when combined with a cut-off valve."

23. For an *Improvement in Locomotive Boilers;* J. E. McConnell, Wolverton, England; ante-dated December 2, 1856.

Claim.—"The fire-box increased in size so as to extend into the barrel of the boiler, and in connexion therewith the tubular stays conveying a supply of fresh air into the extension, whereby the products of combustion are consumed in a more perfect manner. Also, the water tubes, arranged in relation to the fire-box, and the surrounding boiler."

24. For an *Improved Scroll Sawing Machine;* John J. Curtis, East Boston, Mass.

Claim.—"1st, The rotating bed or table, and in such a relation to the saw, that the bed or table may rotate around the cutting edge of the saw as a centre. 2d, The feeding wheel, when used in connexion with a rotating bed or table."

25. For an *Improvement in Machines for Sowing Seed Broad-cast;* Daniel Haldeman, Morgantown, Virginia.

Claim.—"The vertically adjustable graduating bar with recesses, in combination with the vibrating scatterer and agitator connected therewith."

26. For an *Improvement in Manufacturing Screws of Thin Metal;* John L. Mason, City of New York.

Claim.—"The mode of forming screw threads on cups, hollow cylinders or hollow cones, of thin soft metal."

27. For an *Improvement in Machines for Harvesting Hemp;* John B. McCormick, Versailles, Kentucky.

Claim.—"The combination of the adjustable bar and seat, with the bars, rods, movable bar, and narrow platform, when said parts are arranged in relation to each other, to facilitate the harvesting of hemp."

28. For an *Improvement in Atmospheric Churns;* Robert McCutcheon, Towanda, Pennsylvania.

Claim.—"The bellows, the chambers, and the air pipe, when arranged in relation to each other and to the body of the churn."

29. For an *Improvement in Machines for Sowing Seed Broad-cast;* A. C. Miller, Morgantown, Virginia.

"The invention consists in providing the seed box of a sowing machine with a peculiar kind of false bottom for the seed to rest upon, thus preventing the seed from bearing with its full weight on the seed bar, while the seed drops through notches in said false bottom into the seed box, and thence to the ground."

Claim.—"In combination with the adjustable bottom and its openings, and the stirrers, the secondary hinged bottom, composed of the two pieces with their openings, the whole being combined."

30. For an *Improved Implement for Paring Horses Hoofs;* V. N. Mitchell, Concord, North Carolina.

"This improvement consists in dressing or paring the hoofs of horses, and other animals, by placing the bottoms of the hoofs in contact with a knife or cutter, which has an exact movement, and is operated by mechanism."

Claim.—"The reciprocating frame provided with the knife and plate, the frame being attached to the upright, having a recess in its upper end."

31. For an *Improvement in Cast Iron Car Wheels;* Albert L. Mowry, Cincinnati, Ohio.

"The object of my improvement consists in making a wheel free from strain, that strain which is more or less produced by the unequal cooling of the parts of the wheel."

Claim.—"Providing the hub with a concave or other formed channel around the centre of the circumference, and arranging in the said channel the lead and ribs, and then with the hub thus constructed, uniting it with the wheel when the parts of the wheel are made and proportioned."

32. For an *Improved Fluid Metre;* James R. Maxwell, Cincinnati, Ohio.

"The improvement consists in the manner of combining and arranging the parts of the metre together, which prevents the settling of dirt in the apparatus often contained in the water, and causes the metre to work with ease and certainty."

Claim.—"The arrangement of the piston with the parts employed for moving the valve."

33. For an *Improvement in Churns;* Henry C. Nicholson, Mt. Washington, Ohio.

Claim.—"So arranging of the flutter wheels upon bent arms, as that the cream agitated by them shall not re-act against any dividing surface, or be impeded by any surrounding piece, and thus I allow the agitation to be more direct in a vertical line, and not follow the rotation of the shaft on which they are placed."

34. For an *Improved Process of Manufacturing Leather Shoe Binding;* Eugene L. Norton, Charlestown, Massachusetts.

Claim.—"The improved process of manufacturing shoe binding, by dividing the skin or sheet of leather into strips of equal width, joining them at their ends so as to connect them into one long strip, and coloring the same when so formed, the whole being formed of, or reduced to, an uniform thickness, and the fleshy or surplus portions of the leather removed by splitting or otherwise."

35. For an *Improvement in Feeding Grain to Mill Stones;* Milton and Charles Painter, Owing's Mills, Maryland.

Claim.—"Regulating the feed of the grain by the swaging of the cup."

36. For an *Improved Hydraulic Gas Generator;* August F. W. Partz, City of N. Y.

Claim.—"1st, The arrangement of the several parts of my machine. 2d, A cham-

ber attached to, and communicating near, its bottom, with the vessel enclosing the wheel, into which chamber the hollow shaft of said wheel opens and discharges, and which contains an outlet for the air accumulating in its upper part."

37. For an *Improved Apparatus for Condensing Vapors and Gases, and for Evaporating Liquids;* August F. W. Partz, City of New York.

Claim.—"The combination of the revolving perforated disks or sheets, with the vessel containing the liquid of absorption or evaporation into which they dip, and the hood or cover which guides the vapors and gases that are introduced through the unimmersed portions of said disks."

38. For an *Improvement in Oscillating Printing Presses;* Charles Potter, Jr., Westerly, Rhode Island.

"The invention consists in an improved method of regulating the impression, and also of feeding in, and throwing out, the sheets, and is applicable particularly to the press patented by Merwin Davis, July 24, 1855."

Claim.—"1st, The manner of adjusting the impression by means of the levers and screws. 2d, The use and adaptation of the lifting feed board, for carrying the sheet to the grippers, when combined with the oscillating eccentric segment. 3d, Operating the 'fly' by the cam, when so constructed as to cause said 'fly' to conform to the motions of the bed, and oscillating eccentric segment."

39. For an *Improvement in Seed Planters;* Silas G. Randall, Dixon, Illinois.

Claim.—"Hinging the seed hopper with its drive-wheel and other appliances connected with it, to the side pieces of the harrow by the pivoted arms, so that when said hopper is thrown forward, it shall rest on, and be operated by, said drive-wheel, which runs on the ground for that purpose, and when thrown back, rests on said side pieces, and be out of action."

40. For an *Improvement in Harvesters;* Wm. T. B. Read, Alton, Illinois.

Claim.—"Making the shoe in one piece, so that by its peculiar formation, it shall serve not only as a support for the finger bar, and as a support and guide for the inner end both of the sickle bar and connecting rod, but also as a means of preserving the connexion between the connecting rod and the sickle bar."

41. For an *Improved Machine for Making Shovels;* David B. Rogers, Pittsburgh, Pennsylvania.

Claim.—"The use of the rollers, in connexion with the dies and the pitman."

42. For an *Improvement in Die Stock;* John F. Scharer, City of New York.

Claim.—"The arrangement of the die plate when held steadfast, in connexion with the die plate, having a slight adjusting motion."

43. For an *Improved Portable Cross-cut Sawing Machine;* Stephen Scotton, Wayne Co., Indiana.

Claim.—"1st, The peculiar arrangement for feeding the saw to its work, and for changing the saw from a perpendicular to a horizontal position. 2d, A slotted saw and screw bolt. 3d, A block, in combination with the dog."

44. For an *Improved Heel Cutter for Cutting Out Heels of Boots and Shoes;* John Shaw, Natick, Massachusetts.

"The object of my invention is to separate each waste portion entirely from the strip during the foundation of each heel portion."

Claim.—"The cutting wings extended from it, and so as to remove the waste portion from the strip of leather, while the heel-piece is being formed therefrom."

45. For an *Improvement in Cooking Ranges;* Charles J. Shephard, Brooklyn, N. Y.

"The invention relates to the construction of the oven plate next the fire, which is so formed as to produce an enlargement of the oven, and also act as a burning and conducting plate and radiator, to heat the oven at that part which is now generally deficient in operation, thereby heating the ovens more uniformly and with less fuel."

Claim.—"Forming the plate that encloses the whole side of the oven next the fire, with the conductor and radiator, whereby the said radiator, in contact with the fire, conducts the heat to, and disperses the same throughout, the side oven plate, heating the

oven more uniformly, and preventing burning, at the same time that the oven is enlarged."

46. For an *Improvement in Printers' Composing Sticks;* James and Wm. Tidgewell, Middletown, Connecticut.

Claim.—"The application to the slide of a composing stick of the flanch and the screw, in combination with the washer interposed between the point of the screw, and the exterior surface of the foot or bottom stile of the stick."

47. For an *Improved Machine for Filing Saws for Cotton Gins;* Jonathan T. Turner, Bridgewater, Massachusetts.

Claim.—"Giving the files a reciprocating rotary or rolling motion. Also, the adjustable vibrating frame, carrying the traverse rods which operate the files when arranged to vibrate parallel with the plane of the saws, so as to adjust and adapt the files to the saws. Also, giving the saws a continuous rotary motion while they are operated upon by the files, by means of a belt applied directly upon the saw cylinder. Also, a yielding or spring fire holder, in combination with a traversing rod having a reciprocating rolling motion."

48. For an *Improved Method of Uniting the Panels of Portable Fences;* Charles Van De Mark, Oaks Corners, New York.

Claim.—"The end locking piece or board, combined with the locking board and rails."

49. For an *Improvement in Folding Bedsteads;* John B. Wickersham, City of New York.

Claim.—"Securing the side rails in place when the bedstead is in an unfolded position, by the combined operation of the shoulder and pin, inserted above the rail."

50. For an *Improvement in Hat Stands;* John B. Wickersham, City of New York.

Claim.—"The manner of attaching the hooks of hat stands on vertical studs or rods, so that said hooks can be turned around horizontally."

51. For an *Improved Plough Clevis;* J. D. Willoughby, Pleasant Hall, Penna.

Claim.—"The stem and button with its grooves, in combination with the cylinder and its elevation."

52. For an *Improvement in Printing Presses;* Daniel K. Winder, Cincinnati, Ohio.

Claim.—"The construction and arrangement of the roller bearing pivoted to the flattened branch or arm from the driving shaft, and provided with the sliding spring button, in combination with the hook, or equivalent device, for the tripping and inversion of the inking roller between the consecutive inkings."

53. For an *Improvement in Door Bolt;* Amos Westcott, Syracuse, New York.

Claim.—"The supporting and guiding of the rear or inner end of the bolt, by connecting it with the knob shaft."

54. For an *Improvement in Wood Gas Generators;* Charles F. Werner, City of New York.

Claim.—"The arrangement of a movable boiler or retort and cylinder."

55. For an *Improved Hand Implement for Severing the Butts, and Separating Husks from Ears of Corn;* Isaac N. Whitaker, Pecatonica, Illinois.

Claim.—"The cutters and flanches or lips attached to the levers."

56. For an *Improved Machine for Dressing Water Furrows in Land;* Jesse Whitehead, Manchester, Virginia.

Claim.—"In combination with the coulter and mould-boards, which scrape off and smooth the sides of the furrow, and serve to guide and direct the machine along said furrow, the horizontal plate which shaves off the top of the furrow, receives all the excess of earth, and the distributors for scattering the earth therefrom, so as not to leave it in ridges."

57. For an *Improvement in Pickers for Looms;* Thomas J. Mayall, Roxbury, Assignor to self and George N. Davis, Boston, Massachusetts.

Claim.—"A picker made of hard vulcanized rubber without seams."

58. For an *Improvement in Hominy Machines;* Oscar F. Mayhew, Assignor to self and W. H. Weeks, Indianapolis, Indiana.

Claim.—"The combination and arrangement of the concave rings or division, and the adjustable openings."

59. For an *Improvement in Holders for Sad Irons, &c.;* Leon Londinsky, Assignor to self and Adolphus E. Becker, City of New York.

Claim.—"A detachable handle or holder made in sections of wood, to be placed upon the handle of a smoothing iron for tailors and hatters, and laundry use."

60. For an *Improved Process of Splitting Leather and Hides;* Isaie Lippmann, Paris, France, Assignor to Michael J. A. Guiet, City of New York.

Claim.—"The method for splitting skins, and by first submitting them to a fulling or beating action, and then when so prepared, passing them through an apparatus or machine, the cutting apparatus of which has a rapid vibrating motion, against which the skin is projected slowly, by which method of fulling and cutting combined, I am enabled more perfectly to split skins than has heretofore been done."

61. For an *Improvement in Water Gauges for Steam Boilers;* Datus E. Rugg, Assignor to self and Dexter N. Force, City of New York.

Claim.—"The combination of the metallic pipe connected to the steam and water spaces with the surrounding transparent tube or cylinder, to indicate by the ebullition of the fluid in said cylinder the water level of the boiler."

62. For an *Improvement to Prevent Counterfeiting Bank Notes, &c.;* Christopher D. Seropyan, Assignor to Wm. Cousland, City of New York, and John D. Bald, Philadelphia, Pennsylvania.

Claim.—"The application of at least two colors to the manufacture of bank notes, drafts, and all other papers representing value, both of which will equally or nearly so absorb the chemical rays of light, or neither of which will transmit or reflect such rays and leave the colors or the tint of the paper less fugitive than the color of the other parts."

63. For an *Improvement in Door Bolts;* Samuel R. Wilmot, Assignor to Samuel B. Guernsey, Watertown, Connecticut.

Claim.—"The method of forming a raised bar from a flat plate without straining the material injuriously by corrugating the plate at the ends of the bar, and slitting the sides of the bar from the plate."

64. For an *Improvement in Dies for Punching Fork Tines;* Le Roy S. White, Assignor to S. S. Rogers, E. W. Sperry, James H. Ashmead, and Edmund Hurlburt, Hartford, Connecticut.

Claim.—"Supporting the small bars or slender parts of the tempered die by suitable supports or dies of metal."

65. For an *Improvement in Ploughs;* John Ormiston, Centre Township, Assignor to D. N. Allard, Rokeby, Ohio.

Claim.—"Uniting and adjusting the shank of the point to, and with, the shank of the coulter, by means of the head on said piece, the rack on the shank of said coulter, and the stirrup and set-screw."

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66. For an *Improved Blotter;* R. G. Allerton, City of New York.

Claim.—"A blotter having a convex surface containing the blotting material with a handle in the opposite side, so as not to revolve, but to be used by a single rocking motion."

67. For an *Improved Machine for Repairing Railroad Bars;* Lyman Beebe and George F. Smith, Michigan City, Indiana.

Claim.—"The wedge shaped jaws fitted to the iron to be worked, in combination with the iron bed block fitted to receive them, into which they slide, and by which they are firmly held. Also, the two jaws, in combination with the double lever, in which

they rest, and by which they are readily opened by raising to receive and discharge the rails."

68. For *Improved Devices for Holding the Bit in the Brace;* George Benjamin, Avoca, New York.

"The invention consists in providing the brace or bit stock with a convenient and substantial fastening, to hold the bit firmly to the bit stock."

Claim.—"The invention of the hook and lever and standard, as applied to the brace socket, and the application of the spring No. 6, the burr No. 7, and the notch No. 8, on the outside of the brace socket."

69. For an *Improved Machine for Rounding and Backing Books;* Theodore Bergner, Philadelphia, Pennsylvania.

Claim.—"1st, Giving a sliding motion to the clamps by means of segments and pinions, or any equivalents to the same. 2d, The sliding table, plates, and clamps, in combination with the swing frame and rollers. 3d, The employment, in combination with the sliding clamps, of adjustable blocks."

70. For an *Improvement in Machines for Covering Insulated Wire with Lead or other ductile metal;* Samuel C. Bishop, City of New York.

"The improvement in the machine employed in the process to produce my said manufacture, consists of a combination of tubes, or other equivalent conductors, for a current of fluid with the die."

Claim.—"Causing the metal and insulated wire to move in separate channels toward a die, where they are to be united, and preventing the gum from being heated while it and the lead advance toward the die, by a current of fluid passing in a suitable vessel or vessels between the metal and gum, to receive and carry off the caloric."

71. For an *Improved Machine for Grooving Stove Pipe;* Charles Bigelow, Hastings, Minnesota.

Claim.—"The roller having its periphery or face formed of a grooved or concave surface and a flat surface, the roller being placed within a reciprocating bar, and within a yoke, arranged and actuated by the lever and ledges, whereby the roller is shifted or moved automatically at the ends of its strokes or movements, and made to groove and close the joints or seams of the pipes at one operation. Also, the bar, when jointed to the upright, and secured to the projection by the pin, as used in connexion with the lever and spring, so that said bar may be thrown out automatically from the projection, for the purpose of allowing the finished pipe to be removed readily therefrom, and another placed thereon."

72. For an *Improved Steam Heating Stove;* Asa Blood, Norfolk, Virginia.

"The invention consists in making a stove greatly improved, for the purpose of burning wood or coal, and heating by the aid of hot air and steam."

Claim.—"The arrangement of the water chamber, chambers, pillars, and hollow grates, and tubes."

73. For an *Improvement in Machines for Paring, Coring, and Quartering Apples;* Charles F. Bosworth, Petersham, Massachusetts.

"The invention consists in a cheap, simple, and effective method of taking the core from an apple, and cutting the same into cylinders after it has been pared."

Claim.—"In combination with stationary quartering and coring knives, the fork shaft, when so arranged in relation to each other, and to the mechanism operating the machine, that it shall steadily propel the apple in the direction of, and while revolving upon, the axis of the corer, whereby one or more apples may be quartered and cored, while another is pared."

74. For an *Improvement in Metallic Band Fastening for Bales, &c.;* Asa O. Broad, Louisville, Kentucky.

"The invention consists in the peculiar device for uniting the two ends of a metallic hoop for securing bales, packages, &c., and so that it may be readily disconnected, without cutting the hoop or band."

Claim.—"A metallic hoop or band, whose ends are united by the bows or curves, slide, and pin."

75. For an *Improved Self-Loading Cart;* J. S. Brown, Washington, D. C.

Claim.—"The combination of a revolving elevator and a scraper. Also, the employment of the cranks on the axle, for the purpose of raising and lowering the elevator and scraper by simply turning the axle half a revolution. Also, the use of the winch, attached to the projecting end of the axle, for the purpose of giving the proper movement to the said axle. Also, the arrangement of the lifting bars, cranks, bangers, and brace bars. Also, the stops on the frame, arranged in combination with the cranks."

76. For an *Improvement in Machinery for Manufacturing Felt Cloth;* Thomas B. Butler, Norwalk, Connecticut.

Claim.—"1st, The flanched track plates. 2d, The movable tripping plates. 3d, The rising frame and rolls."

77. For an *Improvement in Carpet Fastenings;* David N. B. Coffin, Jr., Newton, Massachusetts.

Claim.—"A screw having a head arranged at one side of its axis, that it may be so applied that the screws may require a turn of only a part of a revolution to secure or to release the carpet after being screwed into their places, and whereby it is made practicable to take up a carpet and replace it in a very short space of time, and with great ease; in other words, I claim the eccentric beaded screws for securing carpets to floors, and for similar purposes."

78. For an *Improvement in Machines for Drying Paste-Board or Paper;* Patrick Clark, Rahway, New Jersey.

Claim.—"The arrangement of the series of hollow heating plates for drying purposes."

79. For an *Improved Catch for Doors;* Jeremiah M. Crosby, Norwalk, Ohio.

Claim.—"The employment of the additional soft spring and connecting slide, or its equivalent, between and in combination with the bolt and main spring."

80. For an *Improved Railroad Switch Lock;* Wm. L. Cawthron, Harper's Ferry, Virginia.

Claim.—"The arrangement upon the lock plate of the curved securing arm."

81. For an *Improvement in Bakers' Ovens;* John Chilcott, Brooklyn, New York.

Claim.—"Providing each car by which the bread is conveyed to and from the oven with a pan or tray that is hung upon journals, and is overturned at a suitable stage in the baking process by the automatic mechanical agency, for the purpose of inverting the position of the bread, and thus causing the bread to be baked more uniformly."

82. For an *Improvement in Rope Machines;* William R. Dutcher, Lansingburgh, New York.

Claim.—"The self-adjusting thimble combined with the cone, when kept towards the said cone by suitable yielding pressure, for the purpose of laying up either the strand or rope, and adjusting itself to any inequality without breaking either the yarns or strands."

83. For an *Improvement in Roofing Machines;* J. B. Driscole, Knoxville, Tenn.

Claim.—"The employment of a swinging bar, hinged or swung between the frame or side plates."

84. For an *Improvement in Grain Separators;* Elishu Dowd, Oshkosh, Wisconsin.

Claim.—"The vibrating shoe provided with the screens, and arranged relatively with the box or chest and deflecting board, in combination with the trunk and fan."

85. For an *Improved Card Printing Press;* Charles E. Emery, Canandaigua, New York.

Claim.—"1st, The general construction of the machine, and the arrangement and combination of its parts, said parts being arranged, combined, and operated in a manner so as to accomplish the object of the invention, the operation of each part being adapted to the vibratory movement by which the machine is operated, and the pressure feeding and discharging contrivances of the machine being combined with the inking arrangement, or with one equivalent to it. 2d, The manner of adjusting and operating the grippers which hold the card, in combination with the manner of operating and

stopping the operation of the plate upon which the card is laid, both being operated by the simple vibratory movement of the moving surface which gives the impression."

86. For an *Improved Machine for Making Horse-Shoe Nails;* Calvin Carpenter, Jr., Providence, Rhode Island.

Claim.—"1st, The attachment of the lower dies to, or the construction thereof, as a part of a plate, which has such a sliding movement, horizontally or otherwise, below the cutter, at right angles to the movements of the cutters, and closing movement of the dies, that the die receives the blank from the cutters while it is in a stationary condition, and then conveys it under the top die, and in returning has the finished nail pushed off it by the lower cutter. 2d, The gauge applied to the lever, or its equivalent, which carries the upper die, in combination with a stationary slotted standard, by which it is moved out of the way as the dies close, and which also serves to adjust it to give a greater or less width to nail blanks."

87. For an *Improved Self-acting Wagon Brake;* M. C. Chamberlain, Johnsonsburgh, New York.

Claim.—"The arrangement of brake bars, slotted arms, and levers, when used for self-acting brakes for vehicles."

88. For an *Improved Mitre Box;* George L. Chapin, Perrysburgh, New York.

Claim.—"The arrangement and combination of the obtuse angled part with the tilting box, both parts being adjustable relatively to each other and to the fixed supporting frame."

89. For an *Improved Machine for Preparing Hub Blocks for the Lathe;* Lovett Eames, Kalamazoo, Michigan.

Claim.—"The vertical and stationary hollow auger guide and rest plate, with cutters attached, in combination with the rotating arbor and screw clamp, attached to the sliding frame."

90. For an *Improvement in Melodeons;* William Evans, Lockport, Illinois.

Claim.—"The arrangement of the swell to close by a movement upwards or away from the reed tubes, instead of downwards or towards the reed tubes in the heretofore usual manner. Also, the stop against which the swell closes attached to the reflecting board, so as to be removed therewith to leave the reeds exposed."

91. For an *Improved Machine for Making Wrought Nails;* Smith Gardiner, City of New York.

Claim.—"1st, The feeding apparatus. 2d, Projecting the finished nail to the rear of the anvil to be cut off. 3d, The eccentric and spring to hold the nail rod when rapidly brought back to its place. 4th, Vibrating the rod under the two hammers, so as to alternately receive a blow on its different sides. 5th, The general combination and arrangement of the several parts of the machine for feeding, presenting, swaging, and cutting off the finished nail, by which I make a wrought iron nail of any specified pattern."

92. For an *Improved Method of Guiding and Cushioning Puppet Valves;* Joseph Hyde and Wm. Stearns, Wilmington, Delaware.

Claim.—"The application to steam engine pump valves, the brace with the piston working into the chamber or cushion to prevent mashing or bruising of the valves."

93. For an *Improved Frame for Camp Tents;* Benjamin Hinckley, Troy, New York.

Claim.—"Making the raftered frame of the tent in sections, hinged together so that the frame can be folded for convenient carrying, the folding frame being provided with the jointed tie-braces, or equivalent devices, for keeping the sections in place when expanded."

94. For an *Improvement in Clay Pulverizers;* Ira Hersey and J. H. Van Riper, City of New York.

Claim.—"The combination of the grated cylinder or separator, open at its ends and supported on its outside by the driving wheels, with the movable and adjustable beaters on the shaft, when the same are constructed and arranged for joint operation."

95. For an *Improvement in Carriage Brakes;* George Hauck, Mechanicsburg, Pa.

Claim.—"Providing the semicircular locking block with an extension arm, and

pivoting it to a bracket of the axle some distance from the point of contact with the hub, and arranging it relatively to the lever and spring."

96. For an *Improvement in Solor Lamps;* Joseph Hassell, Brooklyn, New York.

Claim.—"Making the outer and turning wick tube which surrounds the wick holder, with a helix or helices, to act on a pin or stud projecting from the said wick holder, and preventing the said wick holder from turning by a feather or feathers, or equivalent therefor, on the outer surface of the inner wick tube, in combination with the making of the upper end of the inner and outer wick tubes cylindrical, and with unbroken surfaces in contact with the wick, the better to keep the upper end of the wick parallel with the upper end of the said wick tubes, and for the further purpose of having the surface of the said tubes, where they are in contact or close proximity with the wick, to present unbroken cylindrical surfaces. Also, in combination with the turning wick tube provided with a helix or helices, the employment of a movable nozzle."

97. For an *Improvement in Sewing Machines;* Daniel Harris, Boston, Mass.

"The improvement relates to the mechanism for producing in connexion with the needle, the chain or tambour stitch, and is for application to such machines only as are to sew with this stitch."

Claim.—"The mechanism for forming and interlooping the stitches, consisting of the leak, the catch, the plate, and its projection, the spring, and the needle, when constructed, arranged, and operated together."

98. For an *Improved Wheelwrights' Machine;* E. N. Kilpatrick, Byhalia, Miss.

"The invention is a machine intended for the use of wheelwrights to facilitate the various operations in constructing carriage wheels, and to insure greater accuracy in performing those manipulations."

Claim.—"The combined arrangement of the spoke marking apparatus, cutter frames, gauge rod, and hub holders, in such relation to each other as to enable the tenons of the spokes to be marked and formed with entire uniformity and unerring accuracy."

99. For an *Improvement in Coal Stoves;* John B. Kohler, Philadelphia, Penna.

Claim.—"The three cases, the fire chambers, and their respective openings, the air chambers, with their openings and the partitions."

100. For an *Improved Basin Faucet;* Wm. C. Marshall and Horace W. Smith, Hartford, Connecticut.

Claim.—"The arrangement, application, and combination for drawing hot or cold water through one nozzle."

101. For an *Improved Machine for Felling Trees by Hand;* Elliot T. Miller, Chelsea, Massachusetts.

Claim.—"The vibrating bar with cutter attached, the bar being pivoted in the sliding collar provided with the pawls, and fitted on the rack bar which is attached to the tree by means of the brace and clamp formed of the screw rods passing through the nuts attached to the segment bar, and retained in proper position by the bars."

102. For an *Improvement in the Mode of Hanging Doors;* Albert W. Morse, Eaton, New York.

Claim.—"Giving the roller an independent motion of the door, thereby allowing the roller to adjust itself to the rail, and revolve on it with its plain parallel with said rail."

103. For *Improved Portable Fence;* William Morrison, Carlisle, Penna.

Claim.—"Confining the panels together, and also to the braces and sill, by means of a single bolt."

104. For an *Improvement in Constructing Watch and Locket Rims;* Henry A. Phillips, Providence, Rhode Island.

Claim.—"The shaping burnisher, or its equivalent, for the purpose of producing a continuous rim from the same metal upon the halves of watch and locket cases."

105. For an *Improvement in Rotary Pumps;* Robert Ramsden, South Easton, Pa.

Claim—"The combination of a revolving piston and taper shaped screw."

106 For an *Improvement in Automatic Fans;* Lawrence Rebstock and Nicholas Reimel, Philadelphia, Pennsylvania.

Claim.—"A new article of manufacture, a ventilating fan."

107. For an *Improved Shield and Guide for Circular Saws;* George W. Rodeboy, Milwaukie, Wisconsin.

Claim.—"1st, Suspending over the upper half of a saw which is arranged to hang over the log to be sawed, a stationary metallic shield, for the purpose of supporting the muley head, and serving as a guard to prevent injury to the operator. 2d, The peculiar manner of arranging the circular muley head on the stationary elevated shield, whereby the guides are capable of being adjusted to any position desired, without taking up any portion of the depth of the saw from the collar to the point of the teeth, and are always made to guide the saw just at and above the point of cutting. 3d, The spring, when arranged on the rising and falling muley head, and relatively to the saw."

108. For an *Improvement in Making Lamp Black;* Julius A. Roth, Philadelphia, Pennsylvania.

Claim.—"Supplying lamp black ovens or the flues connected therewith, with air pipes. Also, the combination of the discharging flue or pipes with a tank or reservoir filled with water."

109. For an *Improved Method of Adjusting Circular Saws to their Shafts;* Gardner R. Scriven, Philadelphia, Penna.; ante-dated May 18, 1857.

Claim.—"1st, The combination of the stationary beveled collar on the spindle with the single loose collar, having one beveled face, and the sliding pin connecting said loose collar with the saw. 2d, The plane faced collar fitting the spindle in such a manner as to be easily inclined at an angle with the spindle between two circular saws for cutting tongues and wide grooves in lumber. 3d, The sliding pin in the collar, or through the same into the fixed collar, or through the saw and into the collar, as the case may be."

110. For an *Improved Carriage Wheel;* James D. Sarven, Columbia, Tennessee.

Claim.—"The improvement in carriage wheels, which consists in the employment of flanched metallic collars, or other equivalent devices, in combination with a wooden hub, and these, in combination with the arrangement of the spokes at the hub, by which means strength and support is given both to the hub and to the spokes at or near the hub, and by which means I am enabled to use any desired number of spokes in each wheel, thereby preventing indentations being made in the rim of wheel between the spokes, and by which means I am enabled to use a much smaller hub than those in general use, and at the same time retain a sufficient degree of strength at the hub. Also, the flanched collars, or other equivalent devices, when used in combination with a wooden hub, if the spokes are arranged as herein described, or if arranged in any other manner."

111. For an *Improved Hob for Cutting Screw Chasers;* Gottlob C. Schneider, Washington, D. C.

Claim.—"The hob for cutting the thread of screw chasers."

112. For an *Improved Nail Machine;* Elhanan W. Scott, Lowell, Massachusetts, and Ammi M. George, Nashua, New Hampshire.

Claim.—"Forcing the pointing rolls to revolve and advance at the same time to point the nails or spikes."

113. For an *Improvement in the Manufacture of Boots;* James Scrimgeour, Brooklyn, New York.

Claim.—"The cutting out or otherwise forming a piece of leather or other material to the shape, and the folding of the same to produce the 'upper' of a boot."

114. For an *Improvement in Steering Apparatus for Ships;* Phineas Smith, Patchague, New York.

Claim.—"The arrangement of the movable cogs, plate, pinion, and ropes, for operating the tiller by the steering wheel."

115. For an *Improved Paper File;* D. A. Stiles, West Meriden, Connecticut.

Claim.—"The combination of the double self-acting spring catch with the top or follower."

116. For an *Improvement in Mop-Head;* Edward P. Thompson, Worcester, Mass.

Claim.—"The improved self-acting mop-holder, made, viz: with a spring, and two

bent legs or bars applied together, and operating in manner and in combination with a socket in the handle."

117. For an *Improved Stump Extractor;* Peter Traxler, Scottsburgh, New York.

Claim.—"The combination of the three bars with the slotted beam and lever, said beam being free to revolve. I am aware of the construction of the lever of Lagrouse, and several modifications thereof. I do not claim the reciprocating lever thus used, but simply my combination."

118. For an *Improved Road Scraper;* Hiram Van Pelt, Bath, New York.

Claim.—"The alternate arrangement of the scoops, in combination with the draft rods."

119. For an *Improvement in Gas Burners;* John C. Walsh, Lockport, New York.

Claim.—"The arrangement within the burner of two or more hollow pillars, extending up in the chambers of the burner, with holes made obliquely into the upper end of said pillars for producing counter currents of gas as it flows through the burner, to break its force and regulate the supply of gas to the tip of the burner."

120. For an *Improved Wrench;* Edward J. Worcester, Worcester, Massachusetts.

Claim.—"My improved adjustable fork jaw wrench, as made with its jaws arranged and applied to its handle, and applied to the side of the movable jaw."

121. For an *Improved Machine for Setting Tires on Wheels;* John H. Williams, Pleasant Hill, Ohio.

"The invention relates to the peculiar construction of an apparatus which serves to retain the wheel of a vehicle in a true position during a process of setting the tire on said wheel, preventing said wheel from dishing, and which apparatus affords the means of placing the wheel easily in a horizontal or vertical position, as the operator may require."

Claim.—"Hanging the frame to which the wheel is secured to a revolving shaft, so that the wheel may be turned up into a horizontal position for the facility of working at it, and then into a vertical position to bring the perimeter of the wheel into the water trough."

122. For an *Improvement in Damper Regulator for Steam Boilers;* Patrick White, Brooklyn, New York.

Claim.—"Securing the ends of the flexible tube by the clamps and metallic plugs."

123. For an *Improved Nut Machine;* Samuel H. Whitaker, Cincinnati, Ohio.

Claim.—"1st, The employment of a taper punch, a hollow plunger, or its equivalent, and a taper pointed mandrel. 2d, The combination of the hollow sleeve and the plunger and cutter, with the forming rollers, for the purpose of carrying the nut or washer blanks to and from the said roller."

124. For an *Improvement in Machines for Folding Paper;* James F. Weeks, Columbus, Ohio.

Claim.—"The manner of operating the feed rollers and folders by means of friction rollers, or their equivalents, revolving upon the plane of a wheel or wheels, striking against fingers or tripping arms, or their equivalents, keyed upon the rock shafts to which the feed roller and folders are attached, in combination with spiral springs upon said rock shafts, to return the feed roller and folders to their places, the whole tending to facilitate the rapid, easy, and certain operation of the machine. Also, making slots in said wheel or wheels in which to fasten said friction rollers, or their equivalents, at any desired point, by means of the thimble, bolt, and nut, constituting the movable stud, so that said friction rollers may be moved forwards or backwards to cause the motion of said rock shafts, spiral springs, rollers, and tapes, for the purpose of forming any desired folds in paper, using any number of said slotted wheels, friction rollers, rock shafts, spiral springs, rollers, and tapes, or their equivalents, in combination, necessary for the purpose of producing any number or form of fold required."

125. For an *Improvement in Cheese Hoops;* C. P. S. Wardwell, Lake Village, New Hampshire.

"The invention consists in providing cheese hoops that are constructed with an open-

ing in one side, with a fastening that shall firmly close the hoop or force it open whenever desired during the process of forming cheese."

Claim.—"The combination of the hasp having a bridge or bar at the outer end of its slet, with the oblong button, the two operating together."

126. For *Improved Automatic Saw-Mill Blocks;* Hiram Wells, Florence, Mass.

Claim.—"The devices, or their equivalents, so constructed as to traverse the log towards the saw simultaneously on each head block, and set it automatically, or permit the workman to set the log on either head block, or on all at the same time, by the lever when put in gear with the rack."

127. For an *Improved Method of Incasing Hydronts;* Wm. Barnwell, City of New York, Assignor to Samuel P. Ayres, New Rochelle, New York.

Claim.—"The casing or pipe with its seat and elastic washer, in combination with the hydrant pipe and screws."

128. For an *Improved Valvular Arrangement for Basin, &c., Cocks;* Edward P. Burnham, Assignor to self and Henry A. Chapin, Springfield, Massachusetts.

Claim.—"The new manufacture of basin, cock, or faucet, as made with a turning bib or nozzle, a sliding valve, and a tubular stem."

129. For an *Improvement in Fire Grates or Linings for Fire Pots;* Daniel H. Dean, Lowell, Assignor to Wm. T. Coggeshall, Fall River, Massachusetts.

Claim.—"Arranging the inner surface of each ring of the fire pot cylindrically or vertically, the edges of the rings inclining inwards in such manner as to bring the upper edge of one ring on or about on a level with the lower edge of the ring directly over it, whereby advantages may be gained."

130. For an *Improved Tonguing and Grooving Hand Plane;* Porter A. Gladwin, Assignor to self and Thomas F. Caldicott, Boston, Massachusetts.

Claim.—"The tonguing and grooving cutter or cutters in a single throat, and to slant in one direction, in combination with arranging the vertical guides so that one can stand below the other and the horizontal tongue guides."

131. For an *Improved Machine for Forging Horse Shoe Nails;* Robert Cook, Assignor to self and Samuel Norton, South Abington, Massachusetts.

Claim.—"Arranging each striker in a separate guide lever, and operating such striker by a spring and such guide lever. Also, combining with the pitman and the lever, carrying the feeder, a catch lever, shoulder, and spring catch, whereby the said feeder may be moved and held up to the cutters, and set free therefrom, as circumstances may require."

132. For an *Improvement in Power Printing Presses;* Jedediah Morse, Canton, Assignor to The S. P. Ruggles' Power Press Manufacturing Company, Boston, Massachusetts.

Claim.—"The combination and arrangement of mechanism or devices for supporting the sheet of paper over the carrier or frisket carriage, and guiding and presenting it to the discharging apparatus, such devices consisting of the cords, the rollers, the drum, cord, and the barrel or pulley provided with a spring, or its equivalent. Also, the combination of the cam and stud, with the rocker toggle, and its operating cam. Also, the combination for regulating the rotary motion of the ink fountain rollers, the same consisting of the adjustable stop lever, the connecting rod, the cam, the lever, the weighted plate, and the pawl, and the internal ratchet. Also, combining with the pile platform and the fly, a mechanism which by the reciprocating movements of the fly, shall lower the platform in correspondence with the increase of thickness of the pile, such mechanism being the cam on the fly-shaft, the pawl thereof, and the train of gears and racks applied. Also, the mechanism or combination for imparting to the ink cylinder endwise motions, the same consisting of the grooved pinions or gear, and the inclined gear, constructed, arranged, and applied together."

133. For an *Improvement in Machines for Pegging Boots and Shoes;* Benjamin F. Sturtevant, Assignor to self and Elmer Townsend, Boston, Mass.

Claim.—"In combination with the feeder wheel and its rotary mechanism, a mechanism for imparting to said feeder wheel, and the last reciprocating intermittent endwise movements, whereby the pegging of two ranges of pegs may be effected. Also,

constructing the feed wheel with two series of radial holes arranged in it. Also, the stop lever and its locking slide, in combination with the peg wood feeding mechanism, and made to operate therewith. Also, the tubular peg carrier, when provided with a cutter for separating the peg from the peg wood, and when arranged and made to operate with the peg wood feeder, and the feeder. Also, the combination of mechanism for producing a reciprocating intermittent endwise movement of the feeder wheel, the same consisting of the slider, the stud, the groove, the spring, the pin, the inclined cam, the pin, the tripping clitch, the lever, and slide rest, the whole being applied together. Also, combining with the mechanism for producing the reciprocating endwise movement of the feeder, a weighted arm, or its equivalent, applied to the pegging jack, whereby the shoe and last are maintained in close contact with the feeder, and permitted to move in correspondence therewith. Also, the method of effecting the feeding of the peg wood, that is, by the slider of the peg carrier, the lever, the serrated feeder, and the spring operating together."

134. For an *Improvement in Carpet Bags;* Joseph Zepfel, Assignor to self and John B. Radley, City of New York.

Claim.—"Attaching the half pieces of the divided bottom to the lower corners of the respective frames at right angles, or nearly, to said frames, whereby said bottom and frames support the flexible material of which the bag is composed, whether the same is open or shut."

135. For an *Improvement in Brick Presses;* R. R. Harbour, Oskaloosa, Iowa.

Claim.—"The employment, in combination with the wheel, of the two sets of levers, and arranged eccentrically within a circle, and on a revolving circle plate, and connected with the tops of the moulds of said plate, and with the followers of the same."

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136. For an *Improvement in Mould-Boards for Reversible Ploughs;* Henry S. Akins, Berkshire, New York.

Claim.—"Providing a reversible plough with a mould-board susceptible of torsion, or of being twisted to the right and left, by means of being composed of a series of rods or bars of any desired number, so constructed and arranged with the other parts of the plough, that they can be placed and held alternately in the different positions and directions required for turning alternate right and left furrows."

137. For an *Improvement in Brine Evaporators;* Charles W. Atkinson, Henderson, Kentucky.

Claim.—"Combining a series of horizontal heating tubes with a vertical flue or chimney, when said flue or chimney is combined with an inclosing vertical casing, which has an enlargement at its upper end, entirely above the uppermost of the said heating tubes."

138. For an *Improvement in Card Printing Presses;* Franklin L. Bailey, Boston, Massachusetts.

Claim.—"Applying the guides to the bed so that they may spring or move away from and towards it, and thus not only relieve the card from contact with, and friction against, the surface of the bed, while such card is descending in the guides, but also to operate the knife and allow it to move backward. Also, arranging the guides so as to incline backward from the vertical plane, the same being for the purpose of supporting the card, and enabling the guides to be used without any front lips. Also, the combination of the spring card holder with the card rest or stop, and the feeding guides or mechanism, and the bed and platen, the said car holder being applied to the stop. Also, applying the feed and pressure rollers in a rocker frame, combined with the vibrating frame, and provided with adjustments arranged so as to enable the rocker frame to be tipped a little as occasion may require, to cause the continuous sheet of paper or card board to operate properly with respect to the position of the form on the platen. Also, arranging on the shaft, and so as to operate with a stationary roller, and with the feeding roller, a spring pressure roller to act against the edge of the sheet of card, so as to maintain its opposite edge in a proper position with respect to the type."

139. For an *Improvement in Laths for Buildings;* John L. Brabyn, City of New York.

Claim.—"The forming of the interstices in the form of a dove-tail, or its equivalent,

and the back support for the mortar in the laths themselves, and entirely independent of any thing that may be placed behind them, by grooving one or both edges of the lath on one side, and leaving the other side of the full width, so that when the same are in place, their edges shall join at the back side to prevent the plastering material from pressing through between the laths, the grooves forming the clinches to hold the mortar firmly in place."

140. For an *Improved Safety Attachment for Hatchways;* James Bridge, Augusta, Maine.

Claim.—"The guards or fenders attached to the arbors, which are secured to the underside of the doors, and connected with the flooring by the chains, the above parts being used in connexion with the inclined flanches and springs."

141. For an *Improved Hydrant;* Joel Bryant, Brooklyn, New York.

Claim.—"The invention and use of hydrants and water pipes with two main cylinders, and a cylindrical bottom part with openings, operating in connexion with each other for the admission and discharge of water."

142. For an *Improved Stock for Bench Planes;* Joel Bryant, Brooklyn, New York.

Claim.—"The construction and use of bench planes, having an opening with a backward inclination made by the dispensing with, or the removal of, the lower edge or lip of the plane stock (as existing in bench planes of ordinary construction), the said opening being made for the purpose of avoiding the annoyance produced by splinters or small pieces of wood fastening into the recess, as formed by the said lower edge or lip of the plane stock and the bevel of the plane iron in common bench planes."

143. For an *Improved Rigid Hoop Knife for Splitting Leather;* Dexter H. Chamlain, West Roxbury, Massachusetts.

Claim.—"The rigid and beveled hoop knife."

144. For an *Improvement in Harvesters;* Nicholas Clute, Dunnsville, New York.

Claim.—"The racking apparatus consisting of the endless belt, carrying arms, or rakes, when used in combination with the endless clearing apron, curved and elevated platform."

145. For an *Improved Cork Machine;* Edward Conroy, South Boston, Mass.

Claim.—"The expanding cutters attached to the rods or bars, and operated by the plate attached to the rod, the rods having pins passing through their upper ends, which pins are allowed to slide laterally in their recesses, as the rods are actuated by the plate. Also, in combination with the cutters, the cams, and bed, for feeding the stuff to the cutters."

146. For an *Improvement in the Roller Temple for Looms;* Warren W. Dutcher, Milford, Massachusetts.

Claim.—"The improved roller temple case, made with a cylindrical recess for the reception and protection of one head or end of the toothed roller."

147. For an *Improved Machine for Making Axe Polls;* Richard H. Cole, St. Louis, Missouri.

Claim.—"1st, Constructing a die box of three permanent and three movable sides. 2d, Arranging the vertically acting cutter, and the projecting portions of the sections of the die box, or their equivalents, in such a manner in relation to the other parts of the machine, that the said enumerated parts will operate substantially as described. 3d, Combining the oval punches with the opposite movable sections of the die box, when the said die box is furnished with a sharp edged side, which acts in conjunction with the said oval punches, in converting a rectangular shaped blank into a properly shaped axe poll. 4th, Cutting a rectangular shaped solid blank from the end of a bar, and then driving said blank into a die box, and converting it into a properly shaped axe poll."

148. For an *Improvement in Invalid Bed Elevators;* D. Stringham Dunning, City of New York.

Claim.—"The jointed bars connected by the cross-pieces, the cranes attached to the upright, the winches formed of the sliding pulleys and gear, the ropes or chains attached to the pulleys and cross-pieces of the bars, the whole being combined."

149. For an *Improvement in Steam Pressure Gauges;* Joseph L. Eastman, Boston, Massachusetts.

Claim.—"The arrangement of diaphragm disk bearing against the diaphragm, multiplying lever, compensating spring, and index."

150. For an *Improvement in Making Cast Iron Malleable;* A. K. Eaton, City of New York.

Claim.—"The employment of the oxide of zinc in the production of malleable iron castings, so that the articles whilst under this treatment will have continually presented to them a fresh supply of decarbonizing material."

151. For an *Improved Depilating Compound for Hides;* A. K. Eaton, City of New York.

Claim.—"The depilating process consisting in the employment of the ingredients."

152. For an *Improved Screw Cutter;* James M. Evarts, Westville, Connecticut.

Claim.—"The rotary dies placed within sliding or adjustable plates or sockets attached to the chuck, or an equivalent device."

153. For an *Improvement in Butter Workers;* Charles W. Gage, Homer, New York.

Claim.—"The combination of rollers with scrapers."

154. For an *Improvement in Motion for Preserving Rolling Contact, &c.;* George P. Gordon and Frederick O. Degener, City of New York.

Claim.—"Supporting or hanging a reciprocating bed or plate upon supports placed obliquely or out of parallel with each other, so that the face of such bed or plate shall, as it is moved back and forth, work in contact with the periphery of a cylinder, or with a fixed point or line, or act intermittently against a swinging bed or plate."

155. For an *Improvement in Corn Planters;* Ives W. McGaffey, Buffalo, N. York.

Claim.—"Hanging the swinging frame by boxes upon fixed sleeve boxes, arranged round, but distinct from, the axle, to ensure freedom of the axle against resistance encountered by the ploughs, without in the swinging of the frame varying the relative concentric position of the axle and seed distributing devices thereon, to the seed boxes."

156. For an *Improvement in Chairs for Invalids;* James G. Holmes, Charleston, South Carolina.

Claim.—"The arranging of the joint by which the seat and back are attacked and moved, so that it shall correspond with the hip joint of the human frame, that is, placing it above the seat and in advance of the back. Also, arranging the knee joint in the chair or seat to correspond with that of the human knee joint of the person occupying it. Also, the frame work of metal or other material, by which all the joints and pivots, excepting that of the separate apron which moves with and supports the leg from the knee down, are combined either with or without the arm rest, as may be desired."

157. For an *Improvement in Seed Planters;* Solomon T. Holly, Rockford, Illinois.

"The invention consists in the employment or use of an indicator, whereby the dropping of the seed is indicated, and also the spots or places where it is dropped."

Claim.—"The employment or use of the indicator connected with the valve."

158. For an *Improvement in Bedsteads;* Peter Hinds, Kendall's Mills, Maine.

Claim.—"My improved turn-up bedstead, constructed with two sets of sockets in its bed posts, and with movable or secondary posts provided with connecting lines or bands, by which when the bed is turned up into a vertical position, the bedding may be maintained in place thereon."

159. For an *Improvement in Animal Traps;* Henry Hackman, Jr., Pequea, Pa.

Claim.—"The combination of the self-acting spring board with the platform, horizontal spring, and lever, constructed for the purpose of assisting in throwing off the animal as the platform tilts."

160. For an *Improvement in Sewing Machines;* Daniel Harris, Boston, Mass.

Claim.—"The arrangement of the mechanism for operating the reciprocating looper, and giving it rotation or partial rotation; that is to say, the combination of the inclined

slot plate, the pin, and the stud, or their equivalents, they operating to produce the proper movements of the looper."

161. For an *Improvement in Rudders;* Robert S. Harris, Galena, Illinois.

Claim.—"The application of an outer or second rudder attached to and working on the common rudder. Also, the short tiller held and worked by stationary chains or ropes."

162. For an *Improvement in Safety Pockets;* Horace Harris, Newark, N. J.

Claim.—"The wire frame with the spring for throwing it open."

163. For an *Improvement in the Construction of Gas Generators;* Augustus A. Hayes, Boston, Massachusetts.

Claim.—"My improved gas retort or generator, that is, with only one chamber, and with a compression conduit arranged wholly or partially outside of the chamber of the retort, and so as to pass directly into the stand pipe, and have one entrance or opening into its front end, to be closed either by the door of the retort or by a separate small door, or its equivalent, as circumstances may require. Also, combining with the gas retort and its compression conduit, a means for diminishing the internal area of the passage of the gas through the conduit, in order to produce the amount of compression of the vapors in the chamber which may be required, according to the kind of coal or other material used, the retort by such means being adapted to the decomposition of any bituminous coal, or other gas producing material."

164. For an *Improvement in the Cutting Apparatus of Harvesters;* M. G. Hubbard, Penn Yan, New York.

Claim.—"The mode of attaching the cutters to the cutter bar."

165. For an *Improvement in Machines for Scouring and Setting Leather;* Peter E. Hummel, Pulaski, New York.

Claim.—"The revolving table or bed in connexion with the reciprocating head formed of the plate, having the frames attached in which the shafts are fitted, the shafts being provided with sockets, and adjustable counter poises."

166. For an *Improvement in Ploughs;* Charles B. Ingersoll, Morris, Illinois.

Claim.—"The standard, in combination with the standard arms and shear bar."

167. For an *Improvement in Foot Stove;* John W. Lefferts, Brooklyn, New York.

Claim.—"The lamp fitted or placed within the cylindrical chamber of the box, the lamp being constructed in annular form, so as to have a passage through its centre to feed the flame with air, and the box fitted within the case, the box being provided with the perforated or reticulated plate with passages and draft pipe."

168. For an *Improvement in Ploughs;* Erasmus D. and Leander W. Legg, Speedsville, New York.

"The invention consists in so constructing side hill ploughs that the mould will revolve from side to side as may be desired, while the cutter may be moved from side to side laterally, to accommodate itself to change of the mould board."

Claim.—"The combination of the adjustable cutter and the reversible mould board."

169. For an *Improvement in Railroad Snow Excavators;* S. Y. Ludlum, Oyster Bay, New York.

Claim.—"The tilting box or scoop attached to the sliding frame, and provided with the rod or cutter, and hinge sides, one or both, the frame being attached to the truck, and the box, and rod or cutter, operated by the locomotive through the medium of the cord or chain."

170. For an *Improvement in Machines for Sowing Grain in Drills;* Frederick Moehlmann, Belleville, Illinois.

Claim.—"Having the curved slot of the upper stationary plate terminate in the form of a scroll or letter c, and the slot of the lower plate arranged in such relation to the same, that as the lower plate turns, the seed in order to escape, as they are forced along on a curve by spurs of the turning plate, shall be compelled to take a direction toward the axis of the plate, and thus be saved from being cracked or broken by being compressed between the terminations of the upper and lower slots."

171. For an *Improvement in Corn Planters;* Wm. T. Pepper, Rising Sun, Ind.

Claim.—"The arrangement of the flanches on the periphery of the wheel, when used in connexion with the plate, scrapers, and receiving or conducting spout, or their equivalents. Also, the rocking seed box, having its lower end held stationary during the act of planting by contact with the ground, and operated automatically by the power by which the machine is drawn forward in the described combination with the falling floors, and seed measuring and delivering mechanism, operated by means of racks, by depressing the box against the ground."

172. For an *Improvement in Valve Connexions for Steam Engines;* Benjamin L. Phillips, Providence, Rhode Island.

Claim.—"Interposing the jointed bars or rods to be operated upon by the cams, or their equ valents, between the valves and the connecting block."

173. For an *Improvement in Corn Planters;* Sylvanus Richardson, Jericho, Vermont.

Claim.—"The seed cylinder operated by spring, in combination with slide and spring valve."

174. For an *Improvement in Valve Gear of Steam Engines;* Samuel Swartz, Buffalo, New York.

Claim.—"The tappet or valve lifter upon a wheel or segment, and giving said wheel or segment a rotary motion, in combination with a reciprocating motion. Also, arresting the reciprocating motion of said wheel or segment, and commencing its rotary motion at a point where its rotary motion will cause the tappet to strike the valve-toe on a line (or nearly so) drawn through the centre of the joint, and perpendicular to the line of reciprocating motion."

175. For an *Improved Condensing Apparatus for Salt and Gases;* John C. Fr. Salomon, Baltimore, Maryland.

Claim.—"The combination of a series of blast pipes and free air or water passages, with a succession of receivers."

176. For an *Improved Postage Stamp and Label Sticker;* Coleman Sellers, Philadelphia, Pennsylvania.

Claim.—"The combination of the lips or flanches, or their equivalents, in the label holder, with the follower, or its equivalents, when said lips or said follower, or their equivalents, are made of such a form as to cause the stamps or labels to bulge out beyond the face of the stamp holder. Also, the attachment of the follower, or its equivalent, with the handle to convey the pressure directly to the stamp or labels."

177. For an *Improvement in Refrigerators;* John C. Schooley, Cincinnati, Ohio.

Claim.—"The employment of the double register and openings, in combination with the partition and openings."

178. For an *Improvement in Bending Sheet Metal Pans;* E. A. Smead, Tioga, Pennsylvania.

Claim.—"The two levers operated through the medium of the arms, which are attached to the sliding bar, the lips or jaws of the levers working over the blocks or beds."

179. For an *Improvement in Wiring Tin Pans;* E. A. Smead, Tioga, Penna.

"My invention consists in the employment or use of a segment bar and vibrating bar, in connexion with a stationary bed, and operated by a sliding bar, wherehy the edges of the pan or vessel are closed around the wire in an expeditious and perfect manner."

Claim.—"The combination of the segment bar, vibrating bar, and bed, the bar being operated from the sliding bar through the medium of the link, and the bar being actuated by the beveled or inclined projections."

180. For an *Improvement in Gang Ploughs;* Joseph Sutter, St. Louis Co., Mo.

"The invention consists in placing on a quadrangular frame a series of ploughs, each one of which is to be supported on a pivot (in its 'land side'), so as to vibrate freely and to be so connected and arranged that the ploughman can regulate their dip with facility."

Claim.—"The combination of the ploughs with the frame and pivot."

181. For an *Improvement in Propeller Canal Boats;* George W. Swartz, Buffalo, New York.

Claim.—"So forming the recesses in the plates that they may protect the propeller, and give direction to the current of water moved by the propeller."

182. For an *Improved Method of Elevating Water by Compressed Air;* Archibald Thomson, Detroit, Michigan.

Claim.—"The reservoir or tank formed or provided with two compartments, which are provided respectively with valves, the compartment provided with the air forcing pipe, and eduction pipe, the two compartments by the action of the valves communicating intermittently by means of the pipe and passage."

183. For an *Improvement in Cultivator Ploughs;* Micajah Tolle, Newport, Ky.

Claim.—"The bracket, in combination with the plough beam."

184. For an *Improvement in Excavating Machines;* Alonzo Taggart, Warrenton, Missouri.

Claim.—"The free draft connexion of the scraper by chains, in combination with the balancing suspension chains, and the opposite stay chains, arranged and operating in connexion with the frame and windlass."

185. For an *Improvement in Smut Machines;* James Tompkins, Liberty, Penna.

Claim.—"Constructing machines for cleaning grain of two cylinders, one placed within the other, and of two sets of beaters secured to one shaft passing these cylinders, the whole so arranged that grain being cleansed may be subjected to two separate and distinct agitations in the one machine."

186. For an *Improvement in Mowing Machines;* Jeremy B. Wardwell, Methuen, Massachusetts.

Claim.—"Supporting the finger bar and cutting apparatus from the main shaft."

187. For an *Improvement in Means for Propelling Vessels in Shoal Water;* J. W. Wetmore, Erie, Pennsylvania.

"The invention consists in improved means of operating a propelling or locomotive wheel for the boat on the bottom of the streams."

Claim.—"The arrangement of the arms in relation to each other, and to the crank shaft and toothed wheel."

188. For an *Improvement in Gas Generators;* Ezra W. Whitehead and James L. Conklin, Newark, New Jersey.

Claim.—"The construction and arrangement of the retort, having two flues on opposite sides for strengthening the same, and leaving a larger portion of the walls of the retort for the direct action of the fire."

189. For an *Improvement in Umbrellas and Parasols;* James Willis, London, England; patented in England March 24, 1855.

Claim.—"My improved manufacture of the runner and slider, and top joint collar, as made with its notched flanch of drawn or rolled metal bent into a ring, and constructed in manner and applied thereto. Also, my improved method of confining the wire in the flanch, viz: by means of a flanch made tubular, or with a groove and space formed to admit and receive the circular split ring of a wire bent down laterally on the ring and between the spreaders or ribs, the same not only causing the wire to be grasped between each two joints of the spreaders or ribs, but providing a smooth flanch without any projections likely to tear or injure the cloth cover of the umbrella."

190. For an *Improved Machine for Skiving Boot Counters;* Wm. Butterfield, Boston, and Bradford Stetson, Uxbridge, Assignor to selves and Elmer Townsend, Boston, Massachusetts.

Claim.—"The combination and arrangement of the secondary or adjustable feed roller and skiving cutter with the driving and feeding shafts, and the primary or stationary feed rollers and skiving cutters."

191. For an *Improvement in Machines for Graduating Lineal Measures;* Samuel C. Hubbard, Assignor to Charles C. Hubbard, Middletown, Connecticut.

Claim.—"In combination with dies for imprinting the figures and transverse lines

upon the rule gravers, or points arranged and held for marking the gauge or longitudinal lines on the rule. Also, the pressure disk with one or more indentations on its periphery corresponding to the knuckles of the joints of folding rules, when this is combined with giving to the disk thus constructed, a self-acting reverse motion, to bring it back after each impression of a rule to the precise point whence it started."

192. For an *Improvement in Steam Pressure Gauges;* Joseph H. Miller and John Kailey, Assignors to selves and John Danner, Canton, Ohio.

Claim.—"The bell shaped end of the mercury tube, and the manner of fastening the gum elastic floor to the bottom of said bell shaped tube, by being clamped between the glass and the metal, thus securely protecting the mercury from air, steam, and water."

193. For an *Improvement in Gas Stoves;* Patrick Mihan, Assignor to self and Robert B. Fitts, Boston, Massachusetts.

Claim.—"Arranging an annular gas distributing tube, a perforated or wire gauze mixer, two radiators, an air space within the radiator, and air inlet spaces, the one leading air above, and the other below the surface of the mixer, this arrangement involving inclining the gas mixer and the radiator in opposite directions with respect to one another. Also, the arrangement of the secondary radiator and its discharge tube, with reference to the radiator, the open air space within the latter and the chamber, and the air and gas burning apparatus disposed at the bottom of said chamber."

194. For an *Improved Screw Wrench;* George C. Taft, Assignor to Henry W. Mason, Worcester, Massachusetts.

Claim.—"Arranging the nut between the two male screws, in connexion with applying the auxiliary female screw and its support, with reference to the handle and shank."

195. For an *Improved Portable Steam Sawing Machine;* Samuel R. Wilmot, Watertown, Conn., and Reuben G. Fairbanks, Brooklyn, New York.

"The object of our improvements is to facilitate the attachment of a portable steam sawing apparatus to the object to be sawed, and to render that attachment more secure. Also, to enable the saw to be fed with greater regularity into the wood upon which it is acting, and to facilitate the movement of the apparatus from place to place."

Claim.—"Attaching a portable steam sawing apparatus to the object to be sawed by attaching apparatus at one side of the saw only. Also, the combination of an adjustable lever clamping apparatus with the stock of a portable sawing apparatus, the several parts of the combination being constructed and combined. Also, combining the stock of a steam sawing apparatus with the mechanism for actuating the saw by means of feeding mechanism, constructed and operating so as to feed the saw into the object to be sawed while the latter remains stationary. Also, locking the saw and the mechanism swinging therewith to the stock, so that the parts of the machine may be rigidly connected with each other, so as to facilitate their removal from place to place. Also, connecting the swinging members of a portable steam sawing apparatus with the stock at a point intermediate between the pivots and extremity of the stock."

196. For an *Improvement in Ladies' Skirts;* Edward F. Woodward, Brooklyn, New York.

Claim.—"The employment of the spiral stiffener or cord for stiffening ladies' skirts, &c., together with the saturation thereof."

197. For an *Improvement in Spring Bed Bottoms;* George W. Dow, Assignor to self and Walter F. French, Lynn, Massachusetts

Claim.—"My improved spring bedstead or bed bottom as made with two series of rests or bearers, two elastic bands or belts, and a series of transverse bars or slats, arranged together and in the bed frame."

198. For an *Improvement in Preparing Liquid Rose Pink;* John W. Perry, Assignor to James W. Gates, Boston, Massachusetts.

Claim.—"The combination of the ingredients for producing a transparent liquid rose pink to be used in imitating rose wood, &c., the same consisting of potash, ground red wood, and gum shellac, and water mixed."

199. For an *Improved Keeper for Locks and Latches;* Andrew Patterson, Birmingham, Assignor to J. H. Jones, Pittsburgh, Pennsylvania.

Claim.—"The use and employment, in combination with a blunt or round end latch

bolt, in a double faced or reversible lock case, of a keeper, the face of which is curved or made concave."

200. For an *Improvement in Knitted Fabrics;* Joseph Vickerstaff, Assignor to Martin Landenberger, Philadelphia, Pennsylvania.

Claim.—"A fabric knitted with threads of different colors, and composed of two separate thicknesses interlocked during the process of knitting at any required intervals, by transposing the threads in such a manner that a knitted fabric may be produced both sides of which shall present a plain uninterrupted surface of loops, and free from the loose unknitted threads common to other ornamental knitted fabrics."

201. For an *Improved Ventilating Vault and Platform Light;* John C. Wolvin, Assignor to self and George Peckham, City of New York.

Claim.—"The manner of securing the glass sections in place by the combined operation of the rebate and clamping plate. Also, the groove in the flanch on which the glass rests, to retain a cord of india-rubber or other elastic material or cement, and make a tight joint with the glass. Also, the gutter formed at the centre of the radial bars, in combination with the perforated clamping plate and pipe."

202. For an *Improved Faucet;* David N. B. Coffin, Jr., Newton Centre, Massachusetts, Assignor to the Boston Faucet Company.

Claim.—"The combination of the annular lifter or lifters, guide, and pin, with or without the top incline for closing the valve. Also, pivoting the annular lifter or lifters."

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203. For an *Improvement in Gas Generators;* Napoleon Aubin, Albany, New York.

Claim.—"The use of a charger."

204. For an *Improvement in Printing Presses;* Franklin L. Bailey, Boston, Mass.

Claim.—"The combination and arrangement of the nipper and holding springs applied to the sheet carrier, and made to operate therewith, and whether said springs be made stationary or adjustable laterally on their shaft. I do not claim a sliding platen or plate moving out from beneath the type form, for the purpose of receiving a sheet to be printed, but I claim the combination of the sheet carrier or plate, with ways placed on the platen or vibrating frame on which it slides, so that it may assume the positions for receiving the sheet to be printed, and also for giving the impression to the same."

205. For an *Improvement in Means for Reducing Top-sails;* Thomas Batty, Brooklyn, New York.

Claim.—"1st, The arrangement of one or more bunt pennants, connected with the front of the sail, passing up the front thereof, and connected with the yard, and of a crane neck piece, or its equivalent, attached to the yard to work up and down said pennant or pennants, so that in lowering the yard the wind may be expelled from the bunt of the sail towards the sides. 2d, The arrangement of the flat blocks through which the reef pennants run on the top of the yard."

206. For an *Improvement in Machines for Polishing Raw Hide Whips;* Eugene Blattner, Philadelphia, Pennsylvania.

Claim.—"The grinding pulley and spindles, when a simultaneous rotary motion is imparted to the same, and when they are arranged for joint operation."

207. For an *Improved Method of Holding and Adjusting Plane Irons in their Stocks;* Willard W. Chipman, Lowell, Massachusetts.

Claim.—"The use and application of the apparatus for holding and adjusting the plane iron."

208 For an *Improvement in Grinding Mill;* Ezra Coleman, Philadelphia, Penna.

Claim.—"Having the concave of a cob cutter adjusted in a circular line concentric with its axis, and relatively to the mouth of the feed hopper, so that it may be set to grind faster or slower. Also, the means for insuring the rotation of the cob cutter with the grinder, and its retention in proper place when the grinder is adjusted longitudinally."

209. For an *Improved Saw-Set;* Jacob Erdle, West Bloomfield, New York.

"The invention consists in the peculiar means employed for feeding the teeth of the

saw to the punch, whereby the teeth may be fed to the punch in either direction, and in a very simple and efficient manner."

Claim.—"The two plates or hands when connected to the bar, the bar being actuated by the lever for the purpose of feeding the saw teeth to the punch in either direction."

210. For an *Improvement in Fastening Handles to Baskets;* Anthony Faas, Philadelphia, Pennsylvania.

Claim.—"An improvement in basket handles."

211. For an *Improvement in Vapor Burners;* Horatio Fairbanks, South Brookfield, Massachusetts.

Claim.—"An improved hydro-carbon vapor burner, as constructed with a secondary burner, pipe, recess, and a closing slide arranged to rotate on the body of the burner concentrically therewith, and constructed so as to be capable of either entirely or partially closing the recess, so that air may be excluded more or less from the same, and heat be confined therein, when the said recess is provided with a secondary jet or burner to operate therein."

212. For an *Improvement in Vane Governor for Steam Engines, &c.;* Francis Gustine, Medford, Massachusetts.

Claim.—"The disks or vanes operating directly upon the valve rod toes, whereby the valve is actuated by the varying deflexions of the vanes."

213. For an *Improved Valvular Arrangement for Faucets, &c.;* Edward Hamilton, Chicago, Illinois.

Claim.—"The employment of a hollow conical perforated valve."

214. For an *Improvement in Pumps;* William H. Harrison, Philadelphia, Penna.

Claim.—"The combination of the chamber, barrels, and valved buckets, and rock shaft, lever, and rods, when the whole are arranged and constructed for joint operations."

215. For an *Improvement in Picker Sawing Machines;* John Haw, Old Church, Virginia.

Claim.—"The over-hanging of the saw between braced guides, and the space beween which is adjustable by wedges and slotted braces."

216. For an *Improved Mode of Constructing Stores;* Wm. L. Johnson, Peytonsville, Tennessee.

Claim.—"Constructing the fronts with rails corresponding to those on the floor, and hinged or pivoted thereto for the purpose of throwing down the said fronts in the plane of the floor, and forming a continuous road or track on which the trucks containing the counters, goods, &c., may be readily run out or clear of the building."

217. For an *Improvement in the Manufacture of Iron;* William Kelley, Lyon County, Kentucky.

Claim.—"Blowing blasts of air, either hot or cold, up and through a mass of liquid iron, the oxygen in the air combining with the carbon in the iron, causing a greatly increased heat and boiling commotion in the fluid mass, and decarbonizing and refining the iron."

218. For an *Improved Sawing Mill;* James G. Kennedy, Cincinnati, Ohio.

Claim.—"The arrangements of the several parts of machinery and saw employed in one frame, by which I am enabled to change and run the saw carriage in either direction for sawing both ways, or if desired, saw in one direction, and run the carriage back as usual in the other direction, without sawing at all."

219. For an *Improved Device for Feeding and Limiting the Depth of Hole in Boring Machines;* Levi B. Lloyd, Warwick Township, Penna.

Claim.—"The combination of spring draw, rod, and table."

220. For *Improved Machines for Finishing Brush Handles;* Thomas Mitchell, Lansingburgh, New York.

Claim.—"The arrangement and combination of mechanical devices constituting a machine to be used for the purposes, viz: platform with revolving cutters, crown saw, with the arms and the adjustable platform and cutter wheels, with ther cutters."

221. For an *Improved Hydrant;* George P. Perrini and James E. Boyle, Richmond, Virginia.

Claim.—"The hollow piston rod and nozzle, when so constructed and arranged, in combination with cylinders of unequal diameters, and their corresponding pistons or plungers, that they will be elevated by the pressure of the water from the supply pipe upon the under surface of the piston, and the water withdrawn therefrom."

222. For an *Improvement in Ships' Windlasses;* Joseph Pevey and Abraham Sanborn, Bangor, Maine.

Claim.—"The attachment of the pawls to the slides."

223. For an *Improved Machine for Straightening Knife Blades;* Hiram Pierce, Claremont, New Hampshire.

Claim.—"The employment in conjunction with a drop weight of self-adjusting dies."

224. For an *Improvement in Enameling Iron Pipes and Hollow Ware;* Edward Pierce, Philadelphia, Pennsylvania.

Claim.—"The enameling of the interior surfaces of pipes or cast iron ware, by placing a vitrifiable compound on the core before the core is inserted into the mould."

225. For an *Improvement in Safety Apparatus for Regulating Steam Boiler Furnaces;* Wm. Pike and Isaac R. Scott, Waltham, Massachusetts.

Claim.—"The arrangement of the bent mercury tube, with its float and the parts immediately connected therewith, and the steam pipe whereby the pressure within the boiler is indicated to the eye, the dampers are regulated to suit the pressure required, and when the pressure within the boiler becomes excessive, the fire is extinguished by the escaping steam, thereby forming a safety regulating apparatus, not requiring the supervision of the attendant."

226. For an *Improved Lantern for Lighting Street Gas;* John Reese and Charles N. Tyler, Washington, D. C.

Claim.—"The gas lighter, consisting of the sliding shade, spring and guard."

227. For an *Improved Central Draft Joint of Carriages;* Luther O. Rice, Caistorville, Canada West.

Claim.—"The central draft joint."

228. For an *Improvement in Hardening Axes, &c.;* James N. Rockwell, Napanock, New York.

Claim.—"Providing the box or holder in which the axe is placed with one or more valves."

229. For an *Improvement in Candlesticks;* Timothy Rose, Courtlandville, N. Y.

Claim.—"1st, Making the socket of the candlestick, and the sliding cup within it, of greater diameter than the candle intended to be used therein. 2d, The spur in the bottom of the cup combined with the stays on the inside of the top rim, far the purpose of holding the candle in proper position, leaving space around it for the melted tallow to pass down into the cup."

230. For an *Improvement in Boring Mills;* Wm. Sellers, Philadelphia, Penna.

Claim.—"Revolving the face plate of boring or turning mills in a support, as near as convenient to the periphery thereof. Also, the adjustable step or centre bearing, when this is combined with an outer support."

231. For *Improved Breech Loading Fire Arms;* John Schenkl, Boston, Mass.

Claim.—"1st, The method of stopping the hammer at half cock, by the pressure of the thumb. 2d, The bar, constructed and operated by the pin and lever, for the purpose of cocking the gun, and of returning the barrel into line with the thimble, and locking it therewith."

232. For an *Improved Mode of Securing and Adjusting Plane Irons in their Stocks;* William Stoddard, Lowell, Massachusetts.

Claim.—"The grooved stand double-headed bolt, in combination with the cam and its stand."

233. For an *Improvement in Machines for Cleaning Rice;* John F. Taylor, Charleston, South Carolina.

"The invention consists in giving a necessary movement to a body or mass of rice, placed within a proper shaped vessel, by means of a screw cylinder and guiding or deflecting plate, placed at the bottom of the vessel, the whole being so arranged that the kernels or grains of rice, are made to rub against each other, so that they will be thoroughly deprived of the flour by the attrition produced thereby, and the grain prevented from being bruised or broken."

Claim.—"The screw and cylinder, placed on the rotating shaft, in combination with the spiral projections or ledges formed on the plate, and placed at the bottom of the vessel, the whole being arranged so as to operate conjointly."

234. For an *Improvement in Caligraphs;* Charles Thurber, Worcester, Mass.

Claim.—"Combining a stylus or tracer with a pen or marker, by means of levers of different lengths connected by jointed rods, that the pen or marker may follow accurately but on a reduced scale, all the movements imparted to the stylus or tracer, in combination with the connexion of this mechanism with a desk or table, by means of an universal joint, to give freedom of motion in all directions to the stylus or tracer, and to the pen or marker, whereby a person can write the usual sized characters by tracing characters of a large size. Also, the stylus or tracer, and the pen or marker, combined with the apparatus, or its equivalents, for shifting the paper, whereby the paper is shifted to the distance equal to the space between two lines, by carrying back the stylus or tracer preparatory to tracing another line."

235. For an *Improvement in Steam Boilers;* Harry Whitaker, Buffalo, New York.

"This invention relates to a certain form and arrangement of the grate, and to certain arrangements of water spaces, fire chambers, and fire tubes, for the purpose of obtaining a very great amount of heating surface with a small body of water, yet providing for the proper circulation of the water, so that no highly heated part of the boiler shall be left uncovered by water."

Claim.—"The arrangement in an upright cylindrical boiler of an annular fire chamber, a series of descending fire tubes, a smoke box, and a series of ascending fire tubes, to convey the products of combustion from an external fire through the centre of the boiler."

236. For an *Improvement in Preparing Elastic India Rubber Cloth;* Charles Winslow, Lynn, Massachusetts.

Claim.—"The method of preparing elastic cloth for use, by the application thereto, of parallel lines in the direction of the shortest diagonal of the meshes formed by the threads of the cloth."

237. For an *Improved Machine for Excavating Tunnels;* Charles Wilson, Springfield, Massachusetts.

"The particular object of my machine is to excavate and bore tunnels through earths or rocks, and particularly through the latter, to which it is especially adapted."

Claim.—"1st, Forming grooves in stone or other mineral substance by means of rolling disk cutters on axes set in alternate opposite directions. 2d, Arranging a series of rolling disk cutters, revolving in such a manner as to cut a deep annular groove into the rock. 3d, The arrangement of the scoops and buckets, in combination with the cylindrical wheel and rotary cutters, to free the annular groove of the chips and dirt abraded by said cutters 4th, A bed plate secured in place by the jack-screws, or their equivalents, in combination with a sliding frame, or its equivalent, projected forward as the cutting progresses by means of a screw acting between the fixed and moving parts."

238. For a *Back Ground for Photographs on Glass;* J. W. Wykes, Wheeling, Va.

"The object of my invention is with a single picture to produce the rounded and lifelike image, and stereoscopic pictures."

Claim.—"The application of the enamel to collodion and albumen pictures on glass."

239. For an *Improved Method of Attaching Air Chambers to Pumps;* Charles N. Lewis, Assignor to George C. King, Seneca Falls, New York.

Claim.—"Connecting the air chamber with the cylinder by means of the stuffing-box and follower, applied to the pump and arranged relatively with the several parts."

240. For an *Improved Water Metre;* Peter H. Niles, Assignor to self and Alfred Douglass, Jr., Boston, Massachusetts.

Claim.—"1st, The two pistons operating in a single cylinder, in combination with the differential piston. 2d, The air chamber between the pistons. 3d, The float valve in combinaton with the two-way cock, whereby when the water is shut off, all the chambers of the metre are emptied."

241. For *Improved Taps and Dies for Cutting Screws;* Ira A. Richards, Assignor to Silas Stevens, East Brookfield, Massachusetts.

Claim.—"1st, Cutting away the teeth of taps and dies on one side. 2d, Making the opposite scores which are parallel with the slides in which the two parts of a die work, or at right angles to the partition of the die, both on the same side of the line drawn through the centre of the die."

242. For an *Improvement in Steam Whistles;* Sylvester W. Warren, Assignor to self and Dexter N. Force, Brooklyn (E. D.), New York.

Claim.—"The cap and whistling mouth or mouths, connected to the steam pipe. Also, placing two or more whistling mouths or edges in the whistle at different distances from the orifices for the escape of steam, so as to adapt one whistle to different pressures, without changing the position of any of the parts."

243. For an *Improved Bench Plane;* Thomas D. Worrall, Lowell, Assignor to Thomas F. Caldicott, Charlestown, Massachusetts.

Claim.—"The improved manufacture of carpenters' bench plane or jointer, as made with its handle, its wooden stock, to which said handle is affixed, and a separate metallic cutter holder and cutter clamping devices."

244. For an *Improvement in Cylindrical Throttle Valves for Steam Engines;* James H. Simmons, Erwin, New York.

Claim.—"The arrangement of the latch upon the stem of the valve playing in the recess within the interior of the head of the cylinder."

245. For an *Improved Breech Loading Fire Arm;* Gilbert Smith, Buttermilk Falls, New York.

Claim.—"Making the chamber to receive the charge in the form of a cartridge partly in the barrel and partly in the breech, and so much larger than the general bore of the barrel as to have a shoulder in front to retain the cartridge case thereon till after the discharge, whereby the joint between the breech and the barrel is brought near the middle of the chamber and not in a corner at the extreme rear or in the front thereof, and is caused to be packed by the lateral expansion of an elastic cartridge case. Also, furnishing the said clamping lever with a projection so arranged as to be acted upon by the hammer in the act of cocking the latter, for the purpose of insuring locking the breech and barrel together before the discharge, and effecting the operations of cocking the hammer, and locking the breech and barrel, by one movement. Also, the sight, constructed with a round stem flattened on one side, and having a spring applied to it for the purpose of enabling it to be adjusted and secured at various elevations."

MECHANICS, PHYSICS, AND CHEMISTRY.

*On Soluble Glass, its Preparation and Applications.**

By J. N. von Fuchs.

(Continued from page 125.)

To the porous bodies by which soluble glass is imbibed it communicates an extraordinary solidity. In this category are included almost all objects of burnt clay, such as bricks, tiles, furnace-tiles, pottery, &c., as well as loose limestones and sand-stones, and wood-work.

* From the Lond. Chem. Gaz., No. 347.

The material which is especially applicable to technical purposes in combination with soluble glass, is—

a. Carbonate of lime (chalk, calcareous sand, powdered marble).—When powdered chalk is made into a paste with water, well dried and soaked with soluble glass, it furnishes a very compact mass. According to Buchner, if a fragment of chalk be immersed in moderately concentrated soluble glass, and left in it for about two days, then taken out, dried, and again laid in a more dilute soluble glass for a time, it is completely penetrated by the glass, and when dried, acquires a hardness throughout which approaches very closely to that of marble: it receives a good polish, and does not soften in the least in water, which only acquires a weak alkaline reaction from it. It has also acquired a considerable density. Von Liebig and Buchner have very recently convinced themselves of this remarkable behavior of soluble glass by their own experiments. Chalk consequently furnishes an excellent addition to soluble glass, to bind it firmly and render it insoluble in water.

b. Dolomite appears, from experiments very recently made with it, to excel even limestone in its binding power; and as it is distinctly harder than limestone, the mass prepared with its powder acquires even by this means a greater power of resistance to external actions, both mechanical and chemical. At any rate, it is one of the best means of binding soluble glass, and rendering it insoluble in water; and as it occurs very abundantly in nature, and is widely diffused, it may be obtained almost everywhere without any great expense.

c. Phosphate of Lime (Bone-earth).—Phosphate of lime also furnishes a very compact mass with soluble glass; this hardly differs from that formed with carbonate of lime, although no chemical action or conversion of the constituents takes place.

d. Caustic lime.—When triturated with slaked lime, soluble glass quickly stiffens, and then dries slowly into a tolerably hard mass. In this case a chemical combination of the lime with the glass takes place, and potash is separated, when a sufficient quantity of soluble glass is present. Of course, water cannot injure this product. It may often be employed with good results as an addition to other masses which do not combine well; the addition, however, must be small, as otherwise the penetration of the soluble glass is prevented.

e. Lime disintegrated by exposure to the air (semicarbonate of lime).—This acts very well with soluble glass when triturated therewith; it does not stiffen (coagulate), and dries gradually into a solid mass, which is a chemical product consisting of silicates of potash and lime. This may be very serviceable as an addition to other masses; and as caustic lime is soon converted into semicarbonate by the action of carbonic acid in the air, walls built with lime-water may be, after some time, soaked with soluble glass, in order to give them greater solidity.

f. Powdered Quartz.—Powdered quartz, however fine it may be, exhibits no great adhesiveness with soluble glass, which could hardly have been supposed. If a mortar-like mass be made with it, and this be spread upon a tile previously soaked with soluble glass, it dries in a few days into a solid mass, which resists rain, and acquires a stony hardness on the surface. But when this surface is broken through, the interior is

found to be quite soft and destitute of soluble glass, which has concentrated itself at the surface. It can only receive a perfectly uniform consistence by frequent soaking with soluble glass.

The case is very different when the powder is first mixed with a little lime disintegrated in the air, then treated with soluble glass, and twice subsequently impregnated therewith. In this way the mixture becomes so compact as to leave scarcely anything to be desired.

The same thing takes place with lime-mortar to which quartz-sand has been added, when it is treated with soluble glass after it is thoroughly dry.

g. Burnt Clay and Porcelain Earth.—These bodies also are amongst those with which soluble glass does not combine strongly. Here also the soluble glass collects towards the surface, and leaves a loose powder in the interior, which can only be bound together by frequent additions of soluble glass.

Objects made of different kinds of clay behave very differently when they have been burnt, and, as is usually the case, are porous, so that they imbibe the soluble glass. For example, if a burnt plate of potter's clay, which possesses no great solidity, and may easily be broken, be repeatedly drenched with moderately concentrated soluble glass, and dried after each soaking, it acquires such solidity as to be capable of opposing an obstinate resistance to both chemical and mechanical forces. A plate thus prepared, made out of the so-called sagger clay, not much more than half an inch thick, and so soft that it fell to pieces at the least pressure before its impregnation with soluble glass, is employed by Professor Kaiser as a covering plate in his evaporating furnace, in which vapors of various kinds pass over it; but these have been as yet unable to injure it in a space of about twelve years. Not only plates but articles of pottery of almost all kinds may be rendered solid and durable by soluble glass, that is to say, if they imbibe it well.

h. Oxide of Zinc (Zinc-white) *and Magnesia.*—These two bodies act very energetically upon soluble glass, and here also they exhibit their analogy, which may be recognised in many other chemical combinations, both natural and artificial.

Oxide of zinc may be triturated with soluble glass without the occurrence of any stiffening. This mass, when laid rather thick upon a solid support previously soaked with soluble glass, binds together slowly, and gradually hardens, during which it acquires a great many cracks, and breaks up into numerous small hard fragments, which separate from the support; these are not diffusible in water, to which they only give a slight alkaline reaction, whilst they retain their hardness. From this we may conclude that oxide of zinc enters into an intimate chemical combination with soluble glass.

If the mixture of oxide of zinc and soluble glass be only laid thinly upon the support, it remains firmly attached to it, and furnishes a good coating, to which any color may be given at pleasure.

As this oxide possesses such a strong binding power, and its product with soluble glass presents such a complete resistance to the action of water, it is necessary to add a small quantity to those masses which do not bind sufficiently, mixing it intimately with them before the soluble

glass is added. Even with masses which bind well a small addition of oxide of zinc is not only not injurious, but advantageous, by increasing their solidity, and at all events, preventing the passage of the soluble glass to the surface.

Pure Magnesia, when triturated into a pasty mass with concentrated soluble glass, binds together more quickly than oxide of zinc, and hardens very greatly in drying; but when laid upon a solid basis to a greater thickness than card-board, it frequently cracks, and becomes for the most part loosened from its support. The fragments cracked off show considerable hardness when triturated. The water employed for this purpose has an alkaline reaction, but gives no turbidity with muriate of ammonia, proving that only a little potash is dissolved, but no silica, or at the utmost only a trace.

There is consequently no doubt that magnesia, like oxide of zinc, combines chemically with soluble glass, and like this, may be employed advantageously as an addition to other less binding masses.

With regard to the behavior of carbonate of magnesia towards soluble glass, experiments have only been made with that kind which is known under the name of *Magnesia alba;* these all gave satisfactory results. The mass, made into a paste with concentrated soluble glass, and spread upon a glass plate, soon adhered, and in a few days acquired such solidity, that it held so firmly to the glass plate as to be only separated from it with difficulty with a knife. A few fragments of it were put into water, and digested for some time, when, although the consistence of the mass was not perceptibly altered, some carbonate of potash without silica was dissolved; muriate of ammonia produced no turbidity. A portion of it was pulverized and extracted with water in which some carbonate of potash was dissolved. A portion was mixed with dilute sulphuric acid, when a slight effervescence was gradually produced, magnesia was dissolved together with the potash still present, and silica was left behind in the form of powder, which dissolved easily and completely in solution of potash.

Magnesia alba and soluble glass consequently act chemically upon one another, the silica with a portion of the potash combining with the magnesia, at the same time that some carbonate of potash is formed. *Magnesia alba* consequently is one of the most excellent fixing agents for soluble glass.

i. Gypsum (hydrated sulphate of lime).—Gypsum, when triturated with soluble glass, sets immediately, and during desiccation a large quantity of sulphate of potash or soda effloresces very soon, according as potash or soda-glass is made use of in the experiment. After drying, the mass is scarcely perceptibly firmer than ordinary plaster of Paris. A mutual chemical action takes place here unmistakeably. From this behavior it appears that objects made of plaster of Paris cannot be impregnated with soluble glass to render them more solid and stable in the air, as in consequence of the quick setting it cannot penetrate into them. As a matter of course, this body cannot be employed for the purpose under consideration; and in any operation undertaken with soluble glass and bodies to be mixed therewith, the formation of gypsum must be prevented, and still more must its presence ready formed in them be avoided.

Anhydrite (anhydrous sulphate of lime) and strongly calcined plaster, which, according to the author's opinion, approaches this very closely, promise a better result; but nothing can be stated decidedly upon this point, as the experiments commenced therewith are not yet completed. These and many other experiments with various bodies as to their behavior with soluble glass will be communicated hereafter. These bodies are, heavy spar, fluor spar, oxide of iron, basic iron salts, litharge, white-lead, &c. The bodies here referred to, with their behavior towards soluble glass, are sufficient for the present purpose.

In these experiments, as also in practice, the degree of concentration of the soluble glass employed is by no means indifferent: 1 part by measure of concentrated soluble glass to 2 parts by measure of water, should be the maximum, and 1 part by measure of the same glass to ½ part by measure of water the minimum of dilution, or sometimes a little less, according to circumstances.

If it be too much concentrated or diluted, it very often does not produce the effects required of it. If it be very concentrated, it does not penetrate easily or deeply enough into bodies which are to be impregnated with it; and if it be much diluted and made into a pasty mass with powdered bodies, these may appear sufficiently coherent at first when dried, but in a few days they are found to be more or less loose and soft, and the desired degree of solidity can only be obtained by frequent treatment with soluble glass. By the dilute soluble glass the particles of the body are kept too far apart, so that when the soluble glass contracted, innumerable small interstices are produced, which interrupt the cohesion. The question arises also, as to how far the saturation of such bodies with soluble glass is to be carried, whether until they can take up no more soluble glass, and are completely closed, or only so far that they may remain to a certain extent permeable to it. In the former case the greatest possible solidity is attained; in the latter we gain the advantage of being able subsequently to apply colors, and fix them with soluble glass. The proper proportion must remain to be ascertained by those who set about the attainment of a particular object. It only remains to be remarked, that when a body is completely saturated with soluble glass and closed by it, it may be again opened to a certain extent when it is heated, or when alcohol is burnt upon it once or twice.

In course of time the pores open somewhat of themselves, especially when they are frequently exposed to rain, by which some alkali is carried off, and the silica gradually acquires the predominance, so that at last a complete petrification is effected, and the final object of this process is attained.

Potash-glass, which hardens when intermixed with pulverulent bodies somewhat more rapidly than the soda-glass, may perhaps also give them a rather greater solidity; but the difference is by no means considerable. The soda-glass, however, at any rate possesses an advantage over the former in its greater fluidity, in consequence of which it penetrates into the smallest interstices, pores, and cracks with much more facility than the somewhat sticky and tough potash-glass. This is of some importance to masons and statuaries. As soda does not combine with silica so strongly as potash, and has a great tendency to effloresce by combining

with carbonic acid, this might perhaps give an advantage to the soda-glass, because by this means the silica is more readily set free, and the silicatization of the mass is sooner attained; this, however, must be left to further observatinns.

The double soluble glass seems to unite the properties of the two preceding, and may perhaps deserve a general preference over them, because it contains two basis (potash and soda) with which silica, which prefers entering into double combinations, combines more powerfully.

The soluble glass for fixing, as already stated, has its own proper purpose, but it is also applicable to many other objects, especially in painting.

The first three kinds of soluble glass, when completely saturated with silica, are always more or less turbid or opalescent; this is attributable to imperfectly dissolved and extremely finely divided silica.

To deprive them of this, which may even frequently be economical, we need only and a little silicate of soda, and let them stand for about a day, with frequent stirring. By this means the turbidity completely disappears, the fluid becomes perfectly limpid, if it be not colored by some other (organic) substance.

(To be Continued.)

For the Journal of the Franklin Institute.

On Superheated Steam. By Thomas Prosser, Civ. Eng.

The subject of superheated steam is far from being a new one, but inasmuch as another of those oft recurring efforts to which an imperfect knowledge of the physical laws which govern it is now being made, I have ventured a few *more* words of advice, in the hope of staying the delusion somewhat, to prevent a useless expenditure of time and of money, with a *fearful sacrifice of life itself*, which must inevitably result from the extensive adoption of superheated steam, produced in the manner generally contemplated.

The superheated is probably the only state in which steam should be admitted into the cylinder of a steam engine, for the purpose of fully developing its mechanical effects in the most economical manner, provided that can be done without increasing the danger which necessarily attends its use in any state.

Instead of superheated, however, the subject has been treated more like supernatural, for if the *gain* (that is the term applied) observable, when steam is so used, is really attributable to it as the primary cause, we have an effect from a cause which is in no way adequate to its production, so far at least as our knowledge of the physical nature of steam extends; the effect therefore is supernatural.

It would be no difficult task to show the delusion under which the experimenters themselves have labored, in all those cases which are relied upon to prove the enormous *gain* obtained by using superheated steam; but it would be an endless repetition. I prefer therefore to state what we do know, if any reliance is to be placed on the experiments of Regnault, and others, viz: That all dry gaseous bodies are expanded nearly alike by the absorption of the same total amount of heat, and

that there exists no reason whatever for supposing that steam acts otherwise when superheated.

There is no dogma better supported by inductive reasoning than this, as a physical fact, for although there are no experiments which entirely agree with it, the differences are so small as to be within the possible errors of experiments of so much delicacy. At all events, even the experiments themselves, however selected, do not justify the claims set up in favor of surcharged steam, hot air, carbonic acid gas, alcohol, or ether, and the failure of all of them points to the one same cause.

If steam is an exception to the general rule, we have no reliable experiments which prove it, for those which have been supposed to do so are of no value whatever.

The solution of the difficulty is simply this: superheating the steam prevents its condensation in the cylinder, and therefore avoids a loss, that is all which it can do, and enough too, for that loss is so enormous, that the advocates of the air-pump condenser are compelled almost to ignore it, or to acknowledge this new "spirit" of evil and of error. Of evil because of the extreme danger attending its production, and of error because aiming at the curing of an evil, instead of preventing its existence, for, says the good old proverb, "*prevention is better than cure.*"

When we reflect upon the fact that the air-pump which is used to exhaust receivers in the production of ice, and that the air-pump of a steam engine condenser are of precisely the same character, need we be surprised (or should we not be surprised if it were otherwise,) that a chilling effect is produced upon the inside of a cylinder at a high temperature, and ever exposed to its influence? Surely, the steam which comes in contact with the cylinder and piston must be condensed, and to some extent lose its mechanical power. That the interior (as well as the exterior) surface of the cylinder has to be warmed, is self-evident, but there is a vast difference between doing it by the condensation of the steam at a time when it should be exerting its utmost mechanical effect upon the piston, and doing it through the medium of the superheat while the steam itself is left in full power, uncondensed.

Superheated steam therefore prevents waste; but the processes by which it is generally proposed to superheat it are attended with imminent danger, not only on account of the rapid corrosion of the metal in contact with the steam while being superheated, but also on account of the great immobility of the particles of steam (when so superheated), and their low additional specific heat, which prevents absorption as fast as the metal will allow the heat to pass, and thus renders it liable to become red hot.

Now, expanding high pressure steam before admitting it into the cylinder, has precisely the same beneficial effect in preventing condensation, and is not attended with the danger of superheating; but then comes the bug-bear of *wire-drawn steam.* Now, what does it matter if the steam is throttled, provided we get all the power required from it? If *none* is condensed in the cylinder, all the power in the steam has been utilized. The dense steam will not cost more to make in proportion to its value than any other less dense.

Steam at 200° C. has a pressure of 15·38 atmospheres, and its *total heat* amounts to 667·5° C. according to Regnault. By throttling so as to wire-draw it, as it is called, it assumes the state of *superheated* steam, in consequence of having more heat than is contained in normal steam when so expanded, while at the same time it is deficient of water or density. Supposing it has retained its original amount of *total heat* without any cooling, excepting that occasioned by expansion to four times its volume, the temperature will fall from 200° C. to about 158·3° C., while the density and pressure will be one-fourth of the original steam. Clearly this must be *superheated steam*, for normal steam has no such proportions as we have assumed between its total heat, density, and pressure. But allow this expanded steam to cool down to the point of deposition, which is about 140° C., and pressure 3·576° C., and the same authority as before quoted will inform us that the total heat in such steam is but 649·2° C., having lost 18·3° C. (=667·5—649·2) of total heat by the reduction of its temperature from 200° C. to 140° C. (=60 per cent.) This loss of total heat, which must go into the metal of the cylinder and piston before any condensation can take place, amounts to about 1-36th of the total heat contained in the steam before expansion, and is abundantly sufficient to prevent any condensation in the cylinder, working with ordinary and *further* expansion.

The mechanical effect of the expansion between the boiler and cylinder is lost, but not more so than if it had never been created, since it costs no more to produce high than low pressure steam.

The same weight of fuel will evaporate the same weight of water under all pressures, and, therefore, the hotter the water is, the more rapidly and effectually will it abstract heat from the fuel, for it really contains more of it, and as the fuel is the only source of supply, there must be greater economy in burning it under hot than cold water, and this agrees with Leslie's experiments, which show that water at the boiling point abstracts heat five times more rapidly than it does at the freezing one.

Of course the boiler must be stronger in proportion to the elasticity of the steam to be generated in it, but that need form no objection now, as the use of cast steel instead of iron will fully compensate for the difference.

Cast steel boiler plates are now being used by the English government, and it is to be hoped that this element of safety will ere long be adopted by our own, for with this material a boiler can be made which *cannot* be bursted by mere steam pressure. The author has one of iron which he thinks may claim the same immunity—at all events, he is willing to test it against any other in the United States.

Although, therefore, there are no objections to the making of this high pressure steam, there are some to the using of it, without *letting down.*

In the first place, it may blow off the cylinder cover of a good many engines such as are now built, if it did not burst the steam chest before reaching it, or even the cylinder itself.

In the second place, it may burn up hemp packing, for the tempera-

ture is greater than any cooking oven (200° C. = 392° F.), although not half so hot as air and surcharged steam has been *done at.*

Nevertheless, if high pressure steam is required in the dry state, it can be obtained with safety and simplicity from a multitubular boiler, similar to the one which supplied steam to the fire-engine exhibited in the Park some time since, which raised steam from cold water in five minutes from the time of lighting the fire in the regular safe and honest way, with the tube plate sufficiently covered by the water, and not in that extremely dangerous manner which many others do it, by first heating the metal to almost a red heat, and then projecting the water upon it.

The steam from this fire-engine boiler has moreover, after having been at work some time, left the exhaust pipe and *heater* perfectly dry.

The proportions of such a boiler as will give the required results, appear to be about 1 foot of grate to 60 or 70 feet of recipient heating surface, of which at least one-third should be above the water line, and in among the steam for the purpose of drying it through the medium of the hot gases after they have passed through the water, and have become sufficiently cooled to be used with safety for that purpose. These are equal to the best locomotive boiler proportions, but the application is very different, as the boiler is upright, and the uptake is immensely expanded just below the water line, at the instant the gases are in a state of intense ignition.

I have stated nothing in this communication but simply physical facts, and yet I know very well that a majority of engineers of the present day will condemn them as heretic, and probably knock them on the head with the sledge hammer of *practical experience.* If you are right, said one of our most eminent engineers, we are all wrong. Even so. But *truth*—ah!—*will prevail,* which I intended to prove by some poet, but having forgotton his poetry, will merely reiterate, *will prevail,* without, however, committing myself to the precise time—when.

New York, July, 1857.

Specification of a Patent granted to Henry R. Worthington, *of New York, U. S., for a machine for measuring the flow of Liquids, called a metre.*—[Dated 16th of January, 1856.]

This invention of improvements in metres for measuring fluids relates to that description of metres which have a reciprocating action, and where the cylinder is alternately filled and emptied ; at the same time registering the number of strokes of the piston, which indicates the quantity of fluid that has passed through the metre.

Fig. 1, is a vertical section of the improved arrangement of water metre ; fig. 2, is a plan view of the same ; fig. 3, is a horizontal section; and fig. 4, is a cross section.—A, and B, are two cylinders, which may be cast separate, and placed together, or they may be cast in one piece. Into these cylinders are fitted the four pistons a^1, a^2, b^1, b^2, connected together in pairs by the rods c^1, c^2. Between the pair of pistons b^1, b^2,

* From Newton's Lond Journ., Jan., 1857.

is placed a valve D², similar in form of construction and general principle of action to an ordinary steam slide-valve. Between the pair of pistons a^1, a^2, is also placed a slide-valve D¹, differing only from the

Fig. 1.

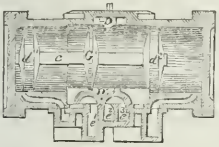
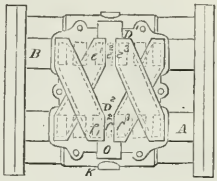


Fig. 2.



last-mentioned in having two cavities in its face instead of one. This difference causes it to admit and discharge the fluid in a direction exactly contrary to what the last-mentioned valve would if moving in the same way. The different directions given by the valves D¹, D², to the fluid, are shown by arrows. Three openings or ports appear under each valve; the ports e^1, e^2, e^3, being under valve D¹, and f^1, f^2, f^3, being under valve D². They correspond with the well known induction and eduction ports, over which an ordinary steam slide-valve is worked. The fluid to be measured is admitted under pressure to the space between the pistons through the openings K, making equal pressure upon the interior faces of them all. Let us suppose the pair of pistons a^1, a^2, to have just completed a stroke from right to left. The projection or disk G¹, on the piston-rod c¹, having been brought into contact with the

Fig. 3.

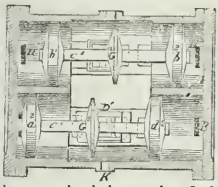
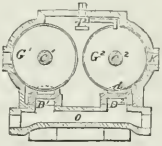


Fig. 4.



valve D¹, has pushed it to the left far enough to admit the fluid into the port e^1; but this port, instead of communicating with the end of the cylinder B, in which the pistons are moving, is carried across diagonally into the end of the cylinder A, (shown by the arrows in fig. 2,) which it enters at H¹, in fig. 3; at the same time the delivery or discharged fluid (shown by the arrow in fig. 1,) flows from the ports e^2, into e^2, and thence through the delivery passage O, from the cylinder A, through the opening H¹, fig. 3, in a diagonal passage indicated on fig. 2, by arrows. The pressure of the influent water having been thus established through the opening H¹, fig. 3, upon the piston b^1, and escape afforded for the fluid behind the piston b^2, through the opening H², this pair of pistons will move from left to right. When near the end of the stroke, the disk G², coming in contact with the valve

D², lying under it, will push such valve across the ports. Diagonal passages similar to those before explained, connect these ports to the ends of the cylinder B. On fluid being admitted into one end, and escape from the other being thus afforded from the cylinder B, the pair of pistons therein contained must return from left to right. On their way they in turn actuate the valve again for the cylinder A, and compel the pistons situated therein to make another stroke. Thus, by the mutual action upon the valves of each other, both pairs of pistons are made alternately and surely to reciprocate. The counter or register may be constructed in any convenient and well known way, and attached to a rod projecting through a stuffing-box, as at P, fig. 4.

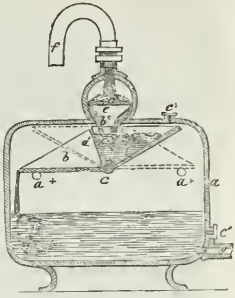
The patentee claims, "the employment of two cylinders in the construction of a metre for fluids, which may be designated as cylinders A, and B, with pistons fitted to work in the same, so arranged and combined with regard to each other as that the motion of the piston in cylinder A, shall, at the proper time, actuate the supply and delivery valve of the cylinder B, while, in like manner, the piston moving in cylinder B, shall actuate the supply and delivery valve belonging to cylinder A; thus mutually determining and regulating the flow of the fluid to and from each other, and producing a positive and direct motion, as herein fully set forth."

Specification of a Patent granted to RICHARD ARCHIBALD BROOMAN, *of Fleet-street, for improvements in apparatus for measuring liquids; which may also be employed as a motive power engine,—being a communication.*—[Dated 19th November, 1855.]

This invention relates to improvements in apparatus for measuring liquids under the pressure of the column, and which is also applicable as a motive power. The principle involved differs materially from the plans hitherto proposed for the purpose, and is distinguished from them by the fact that the measuring vessel, or (in case of motive power) the mechanism used to transmit the force of the water, is worked in compressed air, or some other elastic fluid.

The figure is a sectional elevation of the improved apparatus for measuring liquids. *a*, is an air and water-tight case containing the measuring vessel *b*, which is placed in the upper part of the case. This vessel is a shallow cup, having an inclined or trough-shaped bottom, and resting upon an axle *c*, placed where the two inclined planes meet at the centre. The cup is divided into two parts by a vertical partition *d*. Immediately over the axle *c*, is an aperture *b**, in the top of the case *a*, through which the water or other liquid enters. Above the opening is a second vessel *e*, called the "retarding vessel," partially divided by a plate *d**. *f*, is the supply pipe, which opens into the vessel *e*. The use of the retarding vessel is to break the force of the water entering, and cause it to fall into the measuring cup with as little momentum as possible: this may be accomplished by various means. When the apparatus is employed for motive power purposes, the "retarding" of the water is not required, and the vessel *e*, may be dispensed with.

g, is the delivery-pipe, furnished with a discharge-cock. The operation of the apparatus is as follows:—Supposing the case *a*, to be empty of water and to contain only air of the ordinary atmospheric pressure, the water is admitted through the pipe *f*, and falls into one side of the measuring vessel *b*; because, the axis being below the centre of gravity, it will always be tilted over to one side or the other, until arrested by one of the stops a^*, a^*, and the top of the partition *d*, will then be in such a position that the water can only flow into one side. As soon as sufficient water has entered to overcome the weight of the opposite half, the vessel will tilt over and discharge its contents,—the water then flowing into the compartment opposite, and the action so continuing. As a measure, it is of course only necessary to know how much water is required to overbalance the empty compartment. The discharges are registered by the vibrations of the measuring vessel acting upon any suitable train of clock work and indexes in any well-known manner. As the cock in the outlet pipe remains closed, the water accumulates in the case *a*, and the air therein becomes gradually compressed as the water rises until such compression becomes equivalent to the force due to the height of the column: water will then cease to enter; and it is intended that the measuring vessel be always in this compressed air space. On opening the cock to draw water, the pressure being thereby relieved, the air will expand, and of course the water will enter through the supply-pipe *f*, and act on the measuring cup, as before.



The methods adopted for maintaining the air space are thus stated: It is well known that, as the pressure on it increases, water can be made to absorb more air than it contained under the ordinary conditions of the atmosphere. In the conditions under which this apparatus operates, the air might also be absorbed and carried off by the delivery-pipe, in which case the measuring vessel would cease to work. Aqueduct water, however, carries along with it a quantity of air in bubbles, and the air, thus conveyed, will, it is believed, be sufficient to keep up the supply; but if found not to be the case, it is only necessary to empty the water out of the case *a*, and open an air cock, to obtain a new supply, as occasion may require. c^*, c^1, represent air vents intended for this purpose. On closing the pipes *f* and *g*, and opening the vents c^*, c^1, water will run out of the vent c^1, and air will enter at the vent c^*, until the case *a* is recharged. There are several other ways of effecting this, by self-working arrangements: for example, a small slide-valve may be attached over the aperture c^1, and the stop removed—the vibrations of the measuring vessel working it: thus a few drops of water might be discharged by the opening, and the space in the hollow of the valve, being replaced by air, the air would be carried within on the return movement.

To apply this invention as a motive power engine, some one of the various descriptions of water-wheels is substituted for the measuring cup. In this case the retarding vessel *e*, is not used, as the full momentum of the water will be required. It will be seen, that the power is obtained by the passage of the water through the condensed air medium; therefore it is still available for other purposes, as it will issue with undiminished pressure through the passage *g*.

The patentee claims, "the improvements in apparatus for measuring liquids and for motive power purposes, hereinbefore described, and represented in the drawings annexed."

Specification of a Patent granted to THOMAS TAYLORSON JOPLING, *of Bishop's Wearmouth, in the County of Durham, for an improved construction of water metre.*—[Dated 27th February, 1856.]*

The object of this invention is to simplify the construction of water metres, and to remedy the defects hitherto pertaining to reciprocating metres when employed for measuring water at a high pressure. To this end two measuring cylinders are employed, which are each provided with a working piston, the rods of which severally carry a slide-valve frame. Or, in lieu of the piston, a flexible diaphragm may be used. These cylinders are enclosed in a water-tight case, into which the liquid to be measured first flows before entering the cylinders, and a provision is thus made for the deposit of stones and other extraneous matters that enter with the liquid, instead of allowing them to flow into the measuring cylinders or chambers. These cylinders are so arranged, with respect to each other, that the ports of the one (for letting water into the cylinder at opposite sides of the piston alternately,) will be covered by a loose slide-valve, which is carried by a valve-frame attached to, and actuated by, the piston-rod of the other cylinder. The lead-off passages of the two cylinders all connect with a common discharge pipe; and as the apparatus is double-acting, a continuous discharge will take place. The action of the one piston is so dependent on the other, that all tendency to create shocks or produce sudden and unequal pressure will be avoided. On the frame of one of the slide-valves, teeth are formed for driving a toothed wheel connected with a counting apparatus, and the number of strokes made by the pistons is thus ascertained, and consequently the amount of liquid passed through the metre.

Fig. 1, is a sectional elevation of the improved metre; and fig. 2, is a sectional plan view, showing the arrangement of the inlet and outlet passages and valves. *a*, *a*, is a cast iron water-tight case, composed of two parts bolted together, and enclosing two cylinders or measuring chambers *b*, *b**. In these chambers work pistons *c*, *c**, the piston-rods of which are arranged parallel to each other, and severally carry, at their outer ends, a frame *d*, for supporting and operating the valves *e*, *e*, which govern the supply and discharge passages *f*, and *g*, of the cylinders *b*, *b**. The valve of the cylinder *b*, it will be seen, will be

* From Newton's Lond. Journ., January, 1857.

operated by the reciprocating motion of the piston-rod of the cylinder *b*. *h*, is the pipe for admitting water to the case *a*; and *i*, is a pipe connected to the cylinders *b*, and *b**, by their respective pipes *k*, and *k**: and intended to discharge the water from the metre as it is measured. When the valves are in the position as shown at fig. 2, the filling of the space [1], of the cylinder *b*, will have been just completed, and in that completion the piston will (through its rod and the frame which it carries) have shifted the valve of the cylinder *b**, and thereby have cut off the supply of water to the space [1], of that cylinder, and brought the other end [2], in communication with the outer case *a*. The end [2], will therefore now be filling—and when the filling is on the point of completion, the piston *c**, (by reason of the frame which its rod carries) will cause the valve of the cylinder *b*, to assume the position indicated by the dotted lines, fig. 2, and thereby cut off the supply from the space [1], and let on the water to the other end [2], of that cylinder. From this explanation it will be understood that the valve of the one cylinder is shifted just previously to the completion of the stroke of the piston of the other cylinder, and by the direct action of that piston communicated through the piston-rod and the frame which it carries. Each frame is fitted with turned-up or flanched ends, which act as tappets, and strike respectively the opposite ends of the valve, and cause it to open and cover the passages *f*, and *g*, alternately. For the purpose of keeping the valves *e*, close up to their seats, spiral springs *l*, *l*, are provided; which press lightly against the back of the valves. The valve frame of the cylinder *b**, is furnished at back with two teeth or chamfered ribs *m*, *m*; which during the reciprocating motion of the frame alternately take into the teeth of a wheel *n*, keyed to a shaft *o*, in connexion with any suitable counting apparatus, and thus cause the number of traverses made by the pistons to be marked on the counting apparatus, which number indicates the amount of liquid that has passed through the metre. The passages of the cylinder *b*, it will be seen, are very similar in their arrangement to those for admitting steam to a steam engine cylinder; but those of the cylinder *b**, are arranged so as to cross each other. Their course may be best traced in fig. 1, where the port, shown open, is that for admitting water to the end of the cylinder marked [2], (fig. 2,) and the closed port is that for admitting water to the space marked [1]. (fig. 2,) of the cylinder *b**. The work-

fig I

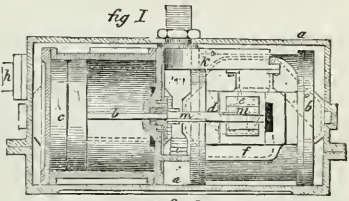
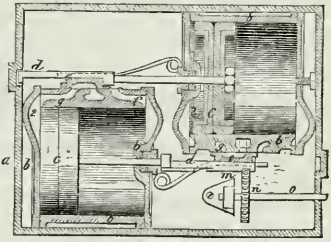


fig 2



ing of this metre, it will be understood, must be smooth or without jerk, as the pistons may be said to float in a body of water,—the pressure being equal, or nearly equal, on both sides of the pistons. The pressure of the water being sustained by the outer case, the internal parts of the metre may be made comparatively light, and there will be little liability of leakage. When diaphragms are applied in place of pistons, they are constructed in any well known and approved manner, and they are connected at their centre to the reciprocating rods which carry the valve frames.

The patentee claims,—"First, the general arrangement of the parts, as above described, whereby I am enabled to measure fluids under great pressure with great facility, and by the simultaneous action of a pair of pistons, or their equivalent, working in their respective cylinders, to discharge the same in a continuous stream from the metre. Secondly, —the use of a water-tight case, in which the measuring chambers are contained, for ensuring an equal pressure of the fluid to be measured on the interior and exterior of the measuring chambers, and permitting of the deposit of extraneous matters contained in the water outside the measuring chambers. Thirdly,—mounting the slide-valves in guide frames carried by the piston-rods of the measuring chambers."

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*On the Employment of Ferrocyanide of Potassium for the removal of Rust-spots in White Linen.** By Prof. Runge.

The employment of ferrocyanide of potassium may often help us out of great difficulties in the case of rust-spots in linen. These do not always consist of common hydrated oxide of iron, but also frequently of oleate of iron, which can only be removed with difficulty, and with the assistance of heat, by oxalic acid, or the binoxalate of potash; and often not at all by sulphuric or muriatic acid, for these acids can only be applied cold and very dilute, as otherwise the linen suffers. From the high price of oxalic acid, therefore, a cheap means is wanting, when a great quantity of such iron moulds is to be destroyed. A case of this kind once occurred to the author, in which sulphate of iron had been used instead of potash, by which 300 napkins and other table linen all acquired a rusty yellow color, which, on being washed with soap, instead of disappearing, became darker; the sulphate of iron being decomposed by the soap, and oleate of iron precipitated upon the fibres.

Immersion even for several days in water acidulated with sulphuric and muriatic acids produced no effect, because the oleate of iron was not decomposed. It was here that the ferrocyanide of potassium did such excellent service. It was added in comparatively small quantity to the water, acidulated with sulphuric acid, and the linen was then moved about in the fluid. The linen became blue. When all the yellow had disappeared, and a clear blue had made its appearance, the linen was rinsed and treated with solution of carbonate of potash. Here the blue color again disappeared, and with it a great part of the yellow, which

*From the Lond. Chem. Gaz. No. 353.

only remained in spots. These were then very easily got rid of by dilute sulphuric acid alone.

The explanation of this process is easy. By the formation of Prussian blue, the oleic acid is separated from the oxide of iron. The carbonate of potash then brought into action combines with the oleic acid, decomposes the Prussian blue, and at the same time also dissolves the greater part of the oxide of iron, so that almost all the iron mould disappears from the stuff simultaneously with the Prussian blue. Caustic ley does not act in the same way; it certainly destroys the blue, but the rusty yellow remains, because it has not the same solvent action upon oxide of iron as carbonate of potash.—*Polyt. Centralbl.* 1857, p. 542.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, August 20, 1857.

Dr. B. H. Rand, President, pro tem., in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from the Royal Cornwall Polytechnic Society, Falmouth, England, and The Kentucky Mechanics' Institute, Louisville, Kentucky.

Donations to the Library were received from the Statistical Society, and the Institute of Actuaries, London; The Smithsonian Institute, and the Superintendent of the U. S. Coast Survey, Washington City, D. C.; The North-western Virginia Railroad Company, and the Maryland Institute, Baltimore, Md.; The Richmond and Petersburg Railroad Company, Richmond, Virginia; The Mechanics' Institute of Tennessee, Nashville, Tennessee; Messrs. A. B. and E. Latta, Buck-eye Works, Cincinnati, Ohio; The Mercantile Library Association of the City of New York; The Trustees of the Free Public Library, New Bedford, Massachusetts; Judge S. Ross, Coudersport, Pennsylvania, John Warner, Esq., Pottsville, Pennsylvania, F. Watts, Esq., Carlisle, Pennsylvania, and the Pennsylvania Hospital; Philip Price, Esq., Robert H. Gratz, Esq., and Prof. John F. Frazer, Philadelphia,

Donations to the Cabinets of Models and Minerals from J. A. Roth, Esq.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for the month of July was read.

The Board of Managers and Standing Committees reported their minutes.

The Committee on Exhibitions reported that, not being able to find at the present time a building of sufficient dimensions to hold the Exhibition of American Manufactures, they recommend to the Institute to suspend the Exhibition for the present year; which, on motion, was done.

New candidates for membership in the Institute (6) were proposed, and the candidates (3) proposed at the last meeting were duly elected.

A specimen of Mr. Williams' Patent Nut for Axles, was shown by Mr. W. Jones, consisting of a nut having a recess cut in the interior, into which

a tongue, let into the screwed end of the axle, and hinged at the outer end, rises by the action of a spring when the nut is screwed home, and prevents the nut from unscrewing. When it is desired to remove the wheel, a small pin is inserted in a hole drilled through the body of the nut, into the recess and upon the tongue, pushing it out of the recess, and permitting the nut to be unscrewed.

Dr. Rand called the attention of the members to a recent important improvement in the chemical arts, made by Mr. Alfred Monnier, of Camden, New Jersey, a gentleman already well known to the members, by his improvements in the manufacture of sodium and aluminum. Mr. Monnier's patent is dated 11th August, 1857, and is for an "Improvement in the manufacture of sulphuric acid from the metallic sulphurets." It is more especially applicable to the native sulphurets of iron, copper, zinc, nickel, and cobalt, and consists in burning off *all* of the sulphur, leaving the metal in the state of oxide.

The process is substantially as follows:—the powdered sulphuret is mixed with a sufficient quantity—say twenty-five per cent.—of dry sulphate of soda, and the mixture made into blocks or balls. These are exposed to a low red heat; if in a furnace, the combustion when once begun, will continue unaided. All of the sulphur is disengaged as sulphurous acid, which is converted into sulphuric acid in the usual way; a small quantity of sulphuric acid is also given off, especially if there be some of the sulphate of the oxide of the metal mixed with its sulphuret.

The residue consists of sulphate of soda, and the oxide or oxides of the metals of which the sulphurets had been burned; these are separated by washing. The solution of sulphate of soda is evaporated to dryness, and thus the same amount of that salt may be used over and over again. The oxides are treated in various ways, according to their nature. Thus the mixture of the oxide of copper and sesquioxide of iron is treated by weak sulphuric acid, which dissolves the former, leaving the latter untouched. When the sesquioxide of iron and the oxide of nickel are mixed they are allowed to remain moist for a few days, when the latter becomes hydrated and soluble in acids, while the former is not changed. The oxide of iron, if in large quantity, may be reduced.

Dr. Rand exhibited specimens of the materials employed, and of the results of the process.

The advantages of the process over the ordinary roasting are readily seen. By using the sulphur so abundantly diffused over the surface of the earth in combination with metals, and which was formerly in great part lost, the price of sulphuric acid may be reduced. The acid may be cheaply made at distant localities, where the cost of transportation of sulphur, or of the acid itself, would be considerable. The acid employed in the metallurgical processes required by the ore, which frequently does not need to be concentrated, can be made on the spot at very low rates. The metals are obtained by a single operation in the manageable form of oxide.

The theory of the process is obscure, and, perhaps, complex. It may depend upon the oxidation of the sulphur by one equivalent of oxygen from the sulphuric acid of the sulphate of soda, which is thus reduced

to sulphite of soda; this sulphite regaining its oxygen from the atmosphere, and becoming again sulphate, as it is found in the residue. Mr. Monnier is engaged in a series of experiments on the nature of the reaction, which, when completed, will probably elucidate the theory.

Mr. Philip Boileau Jones stated, that in England the process named by Dr. Rand has been practised for some time, with the exception of the addition of sulphate of soda. The pyrites being burned raw, in kilns constructed peculiarly, having a small draft, and the ore in the kiln never being allowed to get above a dull red heat, and the sulphur being only slowly eliminated, the oxidation of the sulphur and ore is very nearly perfect, never leaving more than five per cent. of sulphur in the ore, and by this simple process, the whole depending on the regulation of the draft, the poorest ores of copper are rendered capable of being worked at a profit; the ores that he had worked upon not containing more than two or four per cent. of copper, and from thirty to fifty per cent. of sulphur, and the result of this roasting was a residue containing from three to seven per cent. of copper, and not more than three to five per cent of sulphur, and as nearly as possible the remainder of the sulphur is in the said chamber, as sulphurous acid.

Dr. Rand explained that the difference in the processes consisted in the fact that in one it was a mere utilization of the sulphurous acid obtained by ordinary roasting, which had long been done both in England and on the Continent; while in the other there was a complete and rapid combustion of *all* the sulphur, by the agency of the sulphate of soda, and the metal was obtained as oxide, *free from sulphur.*

Dr. Rand requests that the following note may be inserted in the Proceedings of the Meeting.

In the old process of burning pyrites for the manufacture of sulphuric acid, years of experience have shown that it requires three and a half tons of pyrites to be equivalent to one ton of sulphur; that the quantity of nitrate of soda used is at least sixty-five pounds per ton of pyrites: that the sulphuric acid chamber using sulphur will last sixteen or eighteen years, while a similar chamber burning pyrites will last but five or six years. The use of pyrites requires a comparatively much larger chamber than that of sulphur. The use of powdered pyrites gives somewhat better results, but the destruction of the chambers, and the contamination of the acid have caused the attempts in this country to be abandoned.

Mr. Monnier states that with his process the amount of pyrites used is but one-half of that required by the old method, while the quantity of nitrate of soda is less, and will be even less than when sulphur is used, provided too high a temperature be not attained in the burning. This is due to the fact that some sulphate of iron will be formed, and dissolved with the sulphate of soda, and being used again will give some sulphuric acid. He claims that the chamber will last as long, and require to be of the same size as for the burning of sulphur, since only sulphurous acid, with some sulphuric pass into it. The combustion of the pyrites by Mr. Monnier's method, is nearly as rapid as that of sulphur, and as the blocks retain their form, they burn without allowing their solid material to pass over into the chamber.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Gordon's Card Printing Press.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination Gordon's Patent Card Printing Press,

REPORT:—That they have examined the press made by Mr. Gordon, now in operation in the printing-office of Mr. Howell Evans of this city. This press, arranged for printing, cutting, and counting cards automatically, has most of its individual parts in common with other existing machines, it being the *combination* which is claimed principally by the patentee.

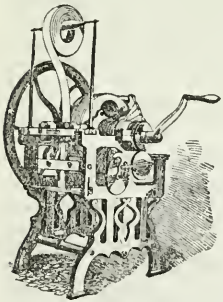
The press consists essentially of a fixed inking or distributing cylinder, of which the movable platen containing the type forms part of the periphery, two sets of inking rollers, which are attached to the extremities of a diametric arm revolving on the axis of the large cylinder, supplying the ink to the type.

The platen containing the type, moves horizontally and in a direction radial to the large cylinder, and presses the card to be printed against a fixed adjustable tympan, making two strokes to each revolution of the inking rollers.

The motion of the platen is said by the inventor to be, and as far as the Committee can discover, is, peculiar to this machine; it being moved by an ordinary crank on a shaft concentric with the large cylinder, instead of the somewhat complicated toggle-joint which has been used in the presses.

This arrangement gives it its capability of running at the great speed which it attains.

The cards are fed to the press in a long strip, wound off of a reel as in a Morse telegraph register, and after passing the platen and receiving the impression, are cut off by a knife working horizontally below the platen, and fall into a basket placed for their reception.



The cards or rather the impressions are counted by an ordinary engine counter, which, in the opinion of the Committee, might be improved both in itself and in the manner of its connexion with the machine.

At the time that it was examined by the Committee, it was on ordinary office work, and was printing from 4800 to 5100 cards per hour, according to the varying speed of the engine below. It is asserted that 10,000 cards can be printed per hour; an assertion which the Committee see no reason to doubt.

The impressions are exceeding perfect and uniform, and the work evidently of the best character.

Altogether the Committee consider the press an exceedingly perfect

machine, and express their high approbation of the great beauty of its mechanical arrangements, particularly the simplification of the *impressing* apparatus by the substitution of the crank for the toggle-joint.

It may be well to state that the greatest number of cards hitherto printed on the best constructed *hand* presses is about 1700 per hour.

By order of the Committee,

Philadelphia, July 9th, 1857. WILLIAM HAMILTON, *Actuary.*

Report on J. H. Cooper's Hand Printing Machine.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a Hand Printing Press, Invented by Mr. JOHN H. COOPER, of Philadelphia, Penna.,

REPORT:—That the instrument as exhibited in the model submitted and described in the accompanying paper, consists essentially in a horizontal wheel, upon whose circumference the type are mounted, and whose axle is capable of a sliding motion in a vertical direction independent of the wheel. The rotation of the axle is effected by a handle attached to it by an intermediate horizontal axis, around which the handle is capable of moving in a vertical plane; but this motion is limited by a point on the projection, attached and opposite to the handle, which when the handle is depressed, rises under the upper rim of the casting, and affords a fulcrum, so that any farther pressure upon the handle will depress the axle of the type-wheel. The letters of the alphabet, and other typographical signs, are arranged around the upper rim, so that when the handle is turned to any one of them, the corresponding type is opposite to the printing apparatus, and the under surface of the rim is drilled with conical holes, into which the projection of the handle fits, so that the type shall be brought exactly opposite to the press, although the index should not be brought exactly to the middle of the corresponding letter. The printing is accomplished as follows:—The axle of the type-wheel, when it is depressed, operates upon the end of a lever which turns a horizontal axis, to which is attached by arms at its ends a horizontal bar, so that as the axis is turned, the bar is rocked forward towards the type-wheel, and the hammer or press being fixed upon this bar, the paper which is carried by properly adjusted rollers, is by it pressed against the type and takes the impression, the type being inked by rollers so placed as to press against their surface at every motion of the type-wheel. Another arm upon the horizontal axis carries a click which falls into the teeth of a rachet wheel, moving this wheel forward one tooth at each depression of the type-wheel axle. This wheel carries a cord attached to a stud on the frame carrying the paper rollers, so that whenever the axle of the type-wheel is depressed and a letter printed, the paper is moved forward sufficiently to space the next letter properly. The various parts are controlled and returned by appropriate springs.

In the opinion of the Committee the apparatus, as arranged by Mr. Cooper, is ingenious, and deserving of praise. In the machine shown to the Committee, the type-wheel carries only capital letters, and in order to make the apparatus practically useful, except in a very limited degree, it will be necessary either to enlarge the wheel to an inconvenient degree, or to add to it a second type-wheel, with adjustments by which the paper may be brought opposite to either of them at pleasure. In the present machine, too, when the line of printing is finished, the frame must be slid back, and the paper advanced for the new line by hand; but it seems to the Committee that it would not be difficult to the ingenious inventor to perform these operations by the machinery. In practice, too, some modifications would be necessary to render the machine more stable and certain in its action than the one exhibited, which is understood to be only the first experimental model.

The Committee therefore deem the machine of Mr. Cooper worthy of commendation for its ingenuity.

By order of the Committee,

Philadelphia, July 9th, 1857. WILLIAM HAMILTON, *Actuary.*

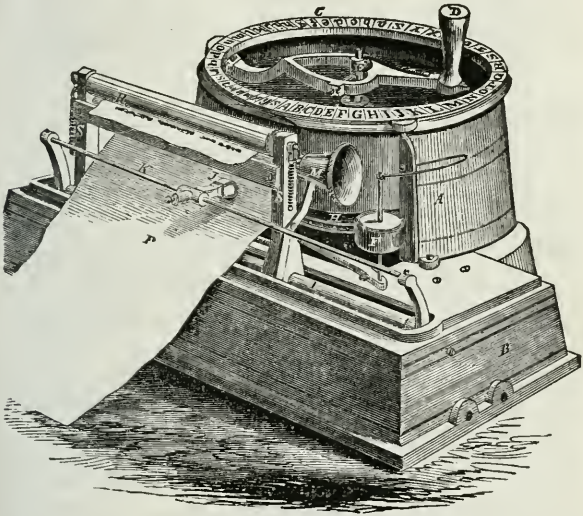
Description by the Inventor.

The type-wheel H, revolves on anti-friction rollers on the sliding axis E, within the case A, and any type desired is brought to the printing place by the hand lever and handle D, pivoted on a cross-pin near the top of E; the pointed end of lever under handle D, indicating the letter desired to be printed. The opposite end of lever has a conical point, which strikes into a countersink on under side of letter circle C, which adjusts the type-wheel *exactly* to the proper place for printing. The paper is stretched between three wires at bottom of frame S S, and rolls R, *near* but *not touching* the type. I is a rocking axis in the middle of which a lever is secured, projecting to the sliding axis E, which rests on its end. On the extremities of axis I are two upward curved levers, connected at their ends by a stout wire K, on its middle and right opposite the type to be printed, a presser bar, faced with a cushion J, is secured:—now it is evident that if the sliding axis E be depressed, the presser bar J will approach the paper and press it against the type and receive an impression; removing the pressure from E, a spring inside of base B, forces lever upwards and J backwards from paper, at the same time actuating mechanism in base B not seen, which draws carriage and paper along for next letter. When the line is printed, the paper frame is adjusted for a new line by turning hand wheel M one "notch," which moves rolls R, and draws the paper through, and pushing frame back to its place of starting.—The type receives ink from two rollers, one F, on near side, and the other on opposite side of machine.

Operation.—To insert the paper: remove the brass wire in the paper frame, by pushing it against the spiral spring on one end of it; introduce one end of paper downwards, between presser bar J and type-wheel and in front of wires—insert the other end between rolls R, and turn them a little to fasten the paper, then put the brass wire in its place again, and by turning rolls R a little more, stretch the paper, allowing the click to rest in its appropriated notch in hand wheel M.

Push the frame s s back to its starting place.

To ink the rollers properly—take a portion of good printer's ink about the size of a grain of wheat, place it on a smooth, clean surface, like tin or plate, remove rollers from machine, and like the operation of rolling pie-dough, completely cover the surface of rolls with the *thinnest film* of ink possible; continue the rolling until the ink to all appearances has disappeared, using no more ink than the quantity specified.—Economy is, *emphatically*, success in this case, as too much ink on rolls will clog the types and deface the paper. It *must* be understood that no good printing can be done on *any* machine when the inking apparatus is not in proper working order.



After replacing the ink rollers, and noticing that the tension of their springs is just sufficient to press them against the types with the slightest touch possible; the machine is then ready for printing.

Take hold of handle D, and move it around until the pointer under it indicates the letter desired, then with a smart and decided, yet free motion of the hand, press the handle downwards, until a "click" is heard, and the impression is made; assist the handle upwards until another "click" is heard, then move to next desired letter and produce its impression, and so on. A little practice will enable any one to print as rapidly as good ordinary writing is done.

To clean the types, dip a clean, soft tooth brush in alcohol or turpentine, and while revolving the type wheel hold it gently against the face of the types.

Abstract of Meteorological Observations made in the State of Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

A. L. Kennedy, M. D., *Chairman.* *July*, 1857.

July, 1857.	Philadelphia.—Latitude 39° 57′ 28″, Longitude 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. Kirkpatrick, Observer.												Easton, Northampton Co.—Lat. 40° 43′ N. Long. 75° 10′ W. Height about 320 feet. S. J. Coffin, Observer.							Somerset, Somerset County. Height about 2750 feet. George Mowry, Observer.				Huntingdon, Huntingdon Co. Jacob Miller, Obs.		
	Barometer.		Thermometer.					Relative humidity.	Force of vapor.	Rain.	Prevail'g winds.		Barometer.	Thermo'tr.	Relative humidity.	Force of vapor.	Rain.	Prevail'g winds.		Barometer.	Thermometer.	Rain.	Prevail'g winds.	Thermometer.	Rain.	Wind.
	Mean.	Mean daily range.	Mean.	Hig'st	Lows't	Daily range.	Mean daily range.	2 P. M.	2 P. M.				Mean.	Mean.	2 P. M.	2 P. M.				Mean.	Mean.			Mean		
	Inch.	Inch.	°	°	°	°	°	Per ct.	Inch	Inches.			Inch.	°	Per ct.	Inch.	Inch.			Inch.	°	Inches.		°	Inch.	
1	29·706	·073	62·8	66	57	9	5·0	73	·470	0·300	E.		29·377	59·0	77	·429	0·02	S. E.					NNW.	64	0·160	W.
2	29·800	·094	59·8	61	56	5	3·0	77	·412		N. E.		29·493	54·3	81	·363	0·06	(var.)		27·614	53·7	0·040	E.	58	0·137	W.
3	29·747	·053	59·7	63	53	10	2·5	72	·415	0·095	N. N. E.		29·430	56·0	79	·410		N. E.		27·658	55·7		N. E.	63		N. E.
4	29·826	·073	66·3	70	59	11	6·7	66	·482		(var.)			65·0	67	·568		(var.)		27·688	62·3		N.	66		(var.)
5	29·905	·085	72·5	78·6	60	18·5	6·2	67	·543		N. N. E.		29·573	71·0	69	·545	0·08	(var.)		27·708	63·0	0·142	(var.)	71	0·182	E.
6	29·930	·035	74·8	80	62	18	2·3	51	·522		S. W.		29·595	70·0	69	·664		(var.)		27·787	68·0	0·005	W.	65	0·364	(var.)
7	29·833	·096	78·3	85	66	19	3·5	44	·530		S. W.		29·487	71·0	48	·487		S. W.		27·762	65·7		W.	72	0·050	W.
8	29·822	·050	79·0	84	66	18	1·3	53	·596		(var.)		29·500		43	·434		N. W.		27·739	71·3		(var.)	72		(var.)
9	29·998	·176	77·7	84	65	19	2·0	45	·525		(var.)		29·670	72·0	48	·527		(var.)		27·790	74·0		S.	76		S.
10	30·050	·063	77·8	82·5	68	14·5	1·8	58	·642	0·007	E.		29·727	71·0	60	·581		E.		27·852	74·3		S.	74		W.
11	29·988	·061	78·0	82	69	13	1·2	63	·689		S. E.		29·653	75·0	59	·584		(var.)		27·837	69·0	0·127	S.	75	0·037	(var.)
12	29·876	·116	82·0	88	69	19	4·0	56	·697		S. W.		29·530	73·0	42	·543		(var.)		27·788	72·3		N. W.	75		S. W.
13	29·823	·054	83·8	90	73	17	3·2	48	·670		S. W.		29·503	80·3	35	·478		W.		27·744	75·3		S.	76·5		S.
14	29·819	·021	80·2	87	70	17	3·7	55	·704		S.		29·487	72·0	63	·765		(var.)		27·706	75·3		S. E.	76·5		S.
15	29·802	·018	80·7	87	72	15	1·5	49	·621		S.		29·487	76·0	53	·597		S.					S. E.	78·5		E.
16	29·798	·012	80·7	85	72	13	2·0	50	·608		S.		29·477	77·0	45	·557		S. E.				0·080	W.	71·5	0·276	(var.)
17	29·772	·026	80·3	85	69·5	15·5	2·3	56	·608		E. N. E.		29·447	75·0	34	·397		(var.)					(var.)	75·5		S.
18	29·727	·045	80·8	84·5	73	11·5	1·5	57	·675	0·016	(var.)		29·393	77·0	49	·650		S. E.		27·632	76·0		(var.)	74	0·093	(var.)
19	29·618	·109	83·8	90	74	16	3·5	53	·750		S. S. W.		29·280	80·3	52	·706		(var.)		27·551	75·0	0·103	S. W.	78		S.
20	29·555	·064	84·2	91	73	18	1·2	49	·699	0·024	S. W.		29·200	78·0	56	·698	1·36	W.		27·433	74·7	0·029	S. W.	74	0·120	S.
21	29·512	·054	82·8	89	74	15	1·3	41	·554	0·005	S. W.		29·150	72·0	63	·691		W.		27·401	64·0	0·072	W.	71	0·120	N. W.
22	29·616	·104	81·0	85	70	15	1·8	47	·669		(var.)		29·260	69·0	68	·614		(var.)		27·469	65·3	0·078	(var.)	75	0·050	S. W.
23	29·669	·043	77·5	83	70	13	3·5	67	·758	0·775	E. S. E.		29·333	69·0	67	·620		(var.)		27·539	64·0		W.	70	0·273	S. W.
24	29·813	·154	77·7	82	66	16	3·5	59	·649	0·437	(var.)		29·493	69·0	81	·655	0·83	N. W.		27·641	68·3		S. W.	70		S. W.
25	29·955	·143	79·3	84·5	70	14·5	1·7	59	·697		S. S. W.		29·627	71·0	68	·724		(var.)					S. S. W.	74		S. W.
26	29·908	·017	82·3	89	73	16	3·0	56	·764		S. W.		29·673		64	·717		W.		27·799	75·7		S.	77		S.
27	29·939	·059	83·0	89	72	17	0·7	53	·720		S. W.		29·603		67	·745		(var.)		27·770	76·0		S.	78·5	0·376	S.
28	29·810	·129	82·5	88·5	74	14·5	2·5	54	·727	0·405	(var.)		29·497	76·0	63	813		(var.)		27·683	71·0	0·395	S. W.	72·5	0·517	N.
29	29·825	·068	81·2	85·5	72	13·5	2·7	52	·642		(var.)			72·0			1·59	(var.)		27·734	67·0	1·325	(var.)	72	0·256	(var.)
30	29·799	·039	72·2	75	68	7	9·0	81	·704	1·377	N. E.		29·493	64·0	94	·583		E.		27·641	67·3		W.	66	0·732	E.
31	29·776	·039	71·8	74·5	65	9·0	2·3	72	·615	0·022	N. E.		29·437	68·0	70	·636		S. E.		27·633	70·7	0·564	(var.)	71	0·204	W.
Me's	29·808	·070	77·3	91	53	14½	2·9	57	·621	3·373	South.			71·6	61	·593	3·94					2·960		72	5·041	

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

OCTOBER, 1857.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Practical Views on the Proposed Improvement of the Ohio River. By W. Milnor Roberts, Civil Engineer.

(Continued from page 158.)

2. The *second objection* is, that the dams though only 8 feet high from pool to pool, will cause a vast increase in the elevation of the great floods, and consequently seriously damage property along the river, and destroy cities, mills, &c., &c. Much stress has been laid upon this objection: so much, indeed, that Mr. Morris has ventured to announce an opinion that it is fatal to the plan. Granting nothing in this stage of the question on this point, the great practical question to be decided is, will such dams create any material additional rise in times of *high freshets?*

Mr. Morris has, to some extent, investigated it, but he confines his observations mainly to the results of a particular case, on the Potomac River, and to one particular flood. He presents a profile of that river, showing the flood line of an 18 feet flood, and its effect with an 18 feet dam; from which it appears, that the increased rise at the upper end of the pool was 5 feet, and at the dam 9½ feet. The natural declivity of the stream being 2½ feet per mile, or two and a half times greater than the Upper Ohio, and *seven* times greater than the Lower Ohio. He then assumes, that "with similar dams on the Ohio, we must expect as a necessary consequence to augment the height of the river floods at least from *five* to *ten* feet; and with the impeded discharge these dams would have in a slackwater navigation from the others necessarily back-

ing their waters against them, there is a strong probability that the augmentation of the floods *would be even greater.*"

Did Mr. Morris pursue this branch of the subject far enough? The writer has frequently been called upon to rebut the apprehensions of non-professional parties in regard to the effect of moderately high dams upon high freshets, but it is rare for an engineer to take this position. The difference in the natural fall of the stream immediately above the pool has an important bearing upon the effect of a sudden flood, such as he describes. It must have descended upon the pool much more rapidly on account of that greater declivity. But upon that same stream imagine a flood of three times the height of the dam, or 54 feet high above the natural river, would that have raised the water 5 to 10 feet higher? Yet this would be only equivalent to a 42 feet flood with the 14 feet dams of the Ohio; and what would be the *additional rise* in such a flood? Something depends upon the suddenness or slowness of the rise. No unbending formula, can by any possibility be made practically applicable to the case; but from experience, sustained by some calculations, a tolerably near approximation to the common and probable result may be had. We must keep the fact in mind, that in such heavy floods the entire body of water in the pool is set in rapid motion, however sluggish it may have been just before, and that the *mass* goes along with the sweeping current, whose velocity is *greatly increased* as it passes the dam, until the entire prism of water has assumed nearly a regular plane along the valley, at comparatively little greater elevation than if the dams had not been there.

On a 42 feet flood on the Ohio at Wheeling, an increase of one foot to the top surface, would add a thousand millions of cubic feet per day to the quantity flowing. The average depth of the proposed pools at low water is to be 10 feet. The total daily flow that would be due to that depth along the unobstructed river, would be only 2,754,000,000 cubic feet, or but 2¾ times the flow due to one foot of depth on top of the flood, and this lower prism of water would be flowing onward with more than *double the velocity* due to its original height of ten feet, and with still greater velocity as it passed the dam. The practical operation is such, that could some Titan wrench the dam entirely from its foundation, and hurl it out of sight, the apparent effect upon the flow of water in the river, would be little more than to equalize the velocity, without varying the surface perceptibly. If we should apply to this case, as analogous, the experience obtained on the Potomac, with an 18 feet flood on an 18 feet dam, we should commit a serious error. If we add "5 to 10 feet," or even 5 feet, to the height of the 42 feet flood on the Ohio, it will be found that the quantity of water that would be required to sustain the flowing prism, would be much greater than the quantity contained in the natural flood added to the artificial portion contained in the pools before the flood came: that it is in the nature of things, under any ordinary circumstances, an impossibility. But waiving for the present all theory, let us turn to further results of experience.

Experience on Rivers with Dams.

The writer has had practical experience in constructing and witnessing the operation of a great number of dams, through a period of

thirty years, on the Lehigh, the Schuylkill, the Swatara, the Susquehanna, and the Juniata, east of the Allegheny Mountains; and on the Monongahela, Big Beaver, Little Beaver, French Creek, Kiskiminetas, Shenango, and Conneaut, west of the Mountains. There are other rivers, such as the Youghiougheny, Muskingum, Kentucky, Green, Licking, Miami, White Water, Des Moines, &c., which have been wholly or partially improved by means of dams, concerning which he has a general knowledge.

The facts, derived from actual observation and from reliable testimony, tend to prove, that those persons living along the streams who were once apprehensive of the effects of the floods, have been agreeably disappointed in the actual results.

As before remarked, no single rule can be made practically applicable upon all these different rivers. The experience of the writer will warrant him, however, in suggesting some general limits as to the probable effects on the Ohio River of dams of the height proposed, in connexion with freshets, as they ordinarily occur, as follows: that where the natural freshet should be twice the height of the dams, or 28 feet, the average *additional* rise along the pools of the 14 feet dams, will not exceed one-fifth of the height of the dam; and that where the natural freshet should be three times the height of the dam, or 42 feet, the additional rise along the pool will not exceed one-tenth the height of the dam; and that where the natural freshet should be four times the height of the dam, or 56 feet, the additional rise along the pool will not exceed one-twentieth the height of the dam. The flood of 1832, which rose 62 feet at Cincinnati, was nearly four and a half times the height of the proposed dams; and had they been in existence at the time, the difference in the height of the water could scarcely have been perceived, as *theory* will in part show, and as experience in part teaches.

The very considerable variations in the width of the Ohio at different points, particularly with reference to high floods, and the variable effects of the side floods, from the larger tributaries, dependent largely upon the relative periods of attaining their greatest force, and upon the particular direction their cross currents may take when entering the main river, have far more influence upon the heights of great floods than these dams can have.

Thus, at one time, the Allegheny will send a back current many miles up the Monongahela, over the dam, and at another time, the Monongahela flood will rush for miles up the Allegheny. The Big Beaver, the Licking, the Kanhawa, or the Cumberland, may be in flood, when there is little or no rise in the Ohio proper; or the Upper Ohio may be in flood when all of the streams just named are quite low. The variations in the heights of floods on different parts of the river from these causes, will be greater than the variations or changes caused by the introduction of the dams. On the Monongahela, where 15 feet dams have been in use many years, and where the larger floods previous to their erection may have been about 30 feet, experience does not show any material *additional* rise. In the spring of 1852, these works were subjected to the severest test from two heavy floods which

"occurred in the month of April—the first from the 3d to the 10th, and the second from the 17th to the 24th, which entirely submerged the improvement, and suspended the receipts. These freshets were both greater than any that have preceded them since the memorable flood of 1832, one of them exceeding that, or any other known upon the Monongahela."

Mr. Morris says, "a remarkable point in the experience of the Monongahela navigation, verifies our freshet profile (fig. 5), in a satisfactory manner, and shows its applicability to those rivers, it is this, that whenever the depth of a freshet on the comb of the Monongahela dams is equal to their lift (8 feet), they are always safely passed by steamboats without using the locks, the dams being completely drowned out. Now our profile (fig. 5), shows that about the point near the head of the pool, where another dam would have been placed to continue a slackwater navigation, the depth from the freshet line to the low water level of the pool is 19 feet, or just double the depth on the comb." He is still using the Potomac River as an exemplification. Although what he states respecting the depth of water, and passing of steamboats over the Monongahela dams is correct, its applicability in the particular comparison made, is certainly doubtful. It shows, at all events, that 8 feet *on* the dam, passes as much water as 26 feet depth just below the dam. Still it proves but little when applied to greater floods. Mr. Morris, pursuing the same train of reasoning, founded on the test on the Potomac, as related, continues, "Hence, we may probably generalize thus far at least, *that with a series of equal dams of about ten feet lift succeeding each other in a slackwater navigation, upon a river of uniform section, the freshet depth on the comb of one is just half the backwater raise above that level at the foot of the next;* consequently, whenever the freshet depths of water upon the combs equals the low water lift of the dams, the top water surface of such freshet will present a continuous inclination, or the dams will be drowned out and passable by boats." This appears to have been partially the case on the Potomac in the instance cited, where the fall of the river above the pool is $2\frac{1}{2}$ feet per mile, the dam 18 feet high, and with an 18 feet flood. It is remarkable in the profile showing the surface line of that flood, that it is represented as being actually one foot *higher* half a mile below the upper end of the pool than it was a mile higher up the stream. This may have arisen in part from some local obstacle, and in part may be attributed to the great declivity of the river, causing the freshet to strike the still water at the pool with great velocity, creating a partial reaction. Such would not be the case on the Ohio River, where the average fall is less than 6 inches per mile.

The inclination of the river must be taken into account in generalizing, when we come to consider the effect of a given *quantity* of water passing in a freshet. Thus, to take extreme cases for an illustration, we have two rivers, one falling 1 foot per mile, the other 10 feet per mile; each to be 100 miles long, with dams of 10 feet lift. The first would take ten dams and pools each ten miles in length; the other would have one hundred dams with pools each but one mile in length. Mr. Ellet has very beautifully exemplified that "a flood is but a lengthened wave,"

and this wave would present very different aspects in passing along these two different rivers, in the velocity of its movement, and in the relative height it would take above the pools. A like quantity of water would of course cause a higher rise in the natural stream of gentler declivity; but the question is, how would freshets of *equal height*, for instance, 20 feet over the natural bed, be affected by the dams on these dissimilar rivers? The "lengthened wave," on the gentler stream, would stretch forward, gradually spreading out along each successive pool; whilst in the other, it would be abruptly checked in its impetuous motion ten times as often in the same distance; so that whilst a flood of 20 feet in the gentler stream might not cause an additional rise of more than about 2 feet or less, a flood of 20 feet on the rapid stream might cause an additional rise of 4 feet or more, over each successive short pool. These figures are merely used to verify the reasoning. Retaining these dissimilar streams still in the mind, how would the comparison stand taking an equal *quantity* of water, and comparing its effect on the two? The quantity that would make a natural flow of 20 feet on the gentler stream, would not be more than 7 feet along the rapid stream—both in their natural condition without dams. On the gentler stream, in passing the dams, we should have about 12 feet depth over them, and on the rapid stream, perhaps about 4 feet depth over the combs. But mark, in the case of the gentler stream, the dams as a system, have caused a rise of only two feet above the natural height of the water immediately below each dam, whilst in the case of the rapid stream, the dams, as a system, have caused a rise of 7 feet immediately below each dam. A simple diagram, which almost any one can make, will render this clear.

There are facts connected with freshets in the Schuylkill River at the Fairmount dam, which have a direct bearing. The precise height of the dam is not recollected, but the writer believes it is about 12 feet above low tide, and about six feet above high tide. The river, at the distance of a third of a mile, perhaps, below the dam, is contracted and absolutely confined by bridge abutments to a width of about 350 feet, which operates to some extent in swelling the *high* floods above the bridge, and on the dam. The effect of sudden floods is dependent in part upon the state of the tide. With these premises before us, let us see how floods have operated there?

In January, 1839, a freshet rose to $10\frac{1}{8}$ feet on the dam, and below the dam to 13 feet above ordinary high tide, or 19 feet above low tide.

In July, 1850, the water was 8 feet on the dam, and $9\frac{1}{4}$ feet above ordinary high tide, or $15\frac{1}{4}$ above low tide.

In September, 1850, it was $10\frac{1}{2}$ feet on the dam, and $13\frac{1}{2}$ feet above ordinary high tide, or $19\frac{1}{2}$ feet above low tide.

We can, in this record, trace the very principle the writer desires to inculcate; although on account of the tidal effect, and the bridge abutments mentioned, the whole rise may have been somewhat greater.

Thus, in the smaller freshet of July, 1850, with 8 feet on the dam, it gave $15\frac{1}{4}$ feet at low tide; so that at most, the flood in the natural stream below was not quite double of the depth on the dam. The

increase appearing to have been $4\frac{3}{4}$ feet, or not quite 40 per cent. of the height of the dam above low tide, with a flood only one and a third times the height of the dam to low tide.

In the freshet of January, 1839, with $10\frac{1}{6}$ feet on the dam, it gave 19 feet above low tide. The *increase* appearing to have been but $3\frac{1}{6}$ feet, or a fraction over one-fourth of the height of the dam, with a flood only one and seven-twelfths times the height of the dam at low tide.

In the freshet of September, 1850, with $10\frac{1}{12}$ feet on the dam, it gave $19\frac{1}{2}$ feet above low tide. The *increase* appearing to have been $3\frac{5}{12}$ feet, or a trifle more, in proportion, than in the January flood of 1839, with a flood only one and five-eighths times the height of the dam to low tide.

It will be observed, that whilst with a flood one and a third times the height of the dam, the *increase* of rise caused by the dam, &c., was *forty* per cent. of the height of the dam; with another flood, one and seven-twelfths times the height of the dam, said *increase* was but *twenty-six* per cent. Thus, although the larger flood was $3\frac{3}{4}$ feet higher, it only raised the water $2\frac{1}{6}$ feet higher; showing how rapidly the relative effect of the dam diminishes with the augmentation of the floods. Let the same principle be applied to floods of double the height here recorded, and the per centage of the *increase* in question will fall accordingly. It will appear that the assumption of one-fifth of the height of the dam is a very liberal allowance to make for the *increase* on a 28 feet flood on the Ohio River, with dams of 14 feet height; and that one-tenth of said height is a liberal allowance for a 42 feet flood.

The practical conclusion, based on experience, and on such reasoning as the nature of the problem has induced in the mind of the writer, is, that the increase of rise and the consequent increase of damage likely to be caused by dams in the Ohio, with vertical heights from pool to pool, not exceeding 8 feet, when placed in comparison with the magnitude of the interests sought to be benefited, will be deemed insignificant.

The reader will readily perceive that this has no reference to another class of damages also referred to—that is, the actual constant *overflowing* of low bottom land, and of a few mill privileges near the mouths of some of the tributaries. Surveys, or the records of old surveys, will show the extent of this character of damages; but judging in part from the results along the Monongahela, it cannot be a very heavy item.

The writer frankly admits that it is a legitimate objection to the system of locks and dams, that *any* increase of rise should be caused at any time in consequence of the dams, but he feels quite confident that undue importance has been attached to it for want of a full investigation.*

3. *The third objection* is, that the "dams will cause the river to be much more frequently and longer obstructed by ice, and will render ice freshets both more frequent and more dangerous."

In considering this objection we must keep in mind the fact, that in

* For further corroboration of the general theory, and of the practical effect of dams, see Appendix.

comparatively low water, such as is common through the winter, the Ohio River is already but a collection of pools and ripples; the latter being in fact nothing more than flat, sloping, natural dams. When these pools shall be made ten feet deeper by the erection of artificial dams, they will be less liable to freeze, and the ice upon them will be thinner on account of the increased depth in the pools. This is an undeniable natural truth. Again, in low water and freezing weather, the steamers are now forced to cease running *sooner* than they will be after the dams are built, thus leaving the river in undisturbed possession of winter's icy fetters; whereas, with the slackwater in constant operation, there will be no *low water*, and steamers will never cease running until *very severe* freezing should set in.

But without pursuing the theory any further at present, let us look at a practical statement introduced by Mr. Haupt on page 21 of his pamphlet.

He says, "The following statement of the detentions caused by ice on the Monongahela, has been furnished by J. K. Moorhead, Esq., and embraces a period of 10 years, from 1845 to 1854 inclusive.

1845,	Feb. 7 to Feb. 14,	inclusive,	8	days.
"	Dec. 7 to Dec. 31,	"	25	"
1846,	Jan. 1 to Feb. 1,	"	32	"
1847,	Dec. 11 to Dec. 16,	"	6	"
1849,	Jan. 10 to Jan. 18,	"	9	"
"	Feb. 15 to Feb. 26,	"	12	"
1851,	Feb. 1 to Feb. 2,	"	2	"
"	Dec. 19 to Dec. 31,	"	15	"
1852,	Jan. 12 to Jan. 31,	"	20	"
1853,	Jan. 26 to Feb. 1,	"	7	"
"	Dec. 28 to Jan. 15, 1854,		19	"
	Total number of days,		155	"

or an average of 15½ days in each year."

Mr. Moorhead also states that, "*the Ohio River has been obstructed by ice nearly the same length of time.*"

Now if the total time per year, namely, 15½ days, were *all* to be considered chargeable to the slackwater navigation, it would not be a very heavy item. Every one can judge how much weight he would allow to the third objection—on the score of the ice question, so far as the period of stopping navigation is concerned.

On the second branch of the objection, that the "ice freshets will be more frequent and more dangerous," we think, on considering the facts, that precisely the reverse will be the case; namely, that they will be *less frequent*, because an equal quantity of water from rains, snows, or thaws, flowing into the deeper and larger pools, would not so readily put the ice in motion, and because the ice being thinner in the first instance, would necessarily be weaker and less dangerous before it commenced moving, and when it did move, it would be immediately broken to pieces at the dam, and go forward in less formidable masses, until it reached its melting or sinking point in the river. Mr. Lothrop, for many years chief engineer on the Monongahela Slackwater, has assured the writer, that such has been the experience there.

The damage from ice, with an experience of 18 years, has not been

serious. Most of the Ohio River is farther south than the Monongahela by several degrees; the most northerly point of the Ohio is only about one-fourth of a degree north of the mouth of the Monongahela. And if a *few* boats on the Monongahela have been able to maintain a perennial navigation lacking but 15½ days per year, will not a much greater number on the Ohio approach that desirable result still more nearly? Theory and experience unite in favor of the assumption that the ice will be less troublesome in every respect after the completion of the slackwater.

4. *The fourth objection* is, that "it will injure the lumber trade and coal business." This is a plain practical objection, which is to be met in a plain practical manner. It is undoubtedly one of great moment. It has been answered in newspaper articles, &c., at different times through a number of years. Mr. Morris, when suggesting in the *Appendix* to his paper, that the writer had committed an oversight in regard to *sluiceways* in connexion with arks, was not perhaps aware of the fact, that the sluiceways proposed in the dams were designed almost wholly for the accommodation of the rafts and arks descending the Allegheny River, which can only run when there is some *rise* in that river, at which time it is presumed they can pass the sluiceways of the dams safely. It was no part of the design, so far as the writer's knowledge extends, to promise a navigation at the sluiceways when there was no corresponding natural navigation on the Allegheny River. The idea was, and is, simply to make such provision for the descending craft of the Allegheny River as would enable them, when they could run to Pittsburgh, to continue on if they so desired, without being compelled to use the locks.

With the proposed extension of the slackwater navigation below Pittsburgh through the whole length of the Ohio River, the idea of using common *arks* for the coal business was exploded, and a system of barges recommended as the proper economical substitute. The day is rapidly approaching, when the scarcity of the right kind of timber will of itself render this step necessary. Arks will be discarded on the Ohio, just as they were on the Lehigh, when the canal was substituted for the descending sluice navigation first constructed. With a good reliable slackwater navigation, the coal business will be augmented to a vast extent, and carried on with an immense saving over the present precarious, costly, and annoying arrangement—if arrangement it can be called. But it is not intended to enter into a detailed investigation of the coal business at this point in the argument. It merely comes up incidentally in the explanation of a misunderstanding in relation to the character and object of the *sluiceway* spoken of as part of the lock and dam system. And yet Mr. Morris is in part correct in his conclusion, when he says, in the *Appendix* alluded to, "for if these sluiceways or chutes are so arranged as to admit the safe passage of those burdensome but frail boxes of pine lumber, called 'coal arks,' which draw six feet water, it is clear that they must also answer for the transit of the stronger steamboat, which never draws so much"—true, when there is six feet clear depth on the sluiceway, it is expected that steamers may and will pass up and down without using the locks.

Mr. Morris proceeds—"In this shape, this plan, in fact, becomes the plan of Mr. Haupt, that of 'low dams and chutes.'" Whereas, when understood, the two things are quite different; Mr. Haupt's plan being designed for low water, with an actual opening through the dam, whilst the sluiceway or chute referred to by the writer, is a mere prolongation or flattening of a portion of the dam up and down stream, not calculated for low water use, the pools being always kept full.

With the slackwater completed between Pittsburgh and the Mississippi River, the entire business would be revolutionized within a few years, from choice on the part of the lumbermen and coal dealers. A large proportion of the lumber, and all the coal, would be conveyed in barges to the Lower Ohio, and thence up and down the Mississippi. Still it is no part of the plan to force trade of any kind. Coal boats, even now, drawing six feet water, cannot with prudence be started from Pittsburgh with less than 10 feet water in the channels, and with such a body of water, the chutes can be so arranged as to permit their safe passage.

Although dams not exceeding 8 feet height from pool to pool may be thus arranged, the writer is at a loss to know how such an arrangement can be made in dams fifty to one hundred feet high, as proposed by Mr. Ellet and Mr. Morris for the Allegheny River above Pittsburgh, notwithstanding Mr. Morris has intimated that "it is not difficult." Another argument of Mr. Morris, fortunately applies below as well as above Pittsburgh. He says, "that the lumber will only be passed down at stated periods, forms no objection: since with unobstructed streams, it is only *occasionally*, and at very *uncertain* times, that it can now be run at all."

To the mind of the writer it appears clear, that whatever objection there may be—on account of the descending navigation interests—to the improvement of the Ohio River by means of low dams, will be much more forcible in connexion with the high dams suggested as part of Mr. Ellet's plan, notwithstanding the latter are to be placed above Pittsburgh.

5. *The fifth objection* is, "the cost, cost of maintenance and tolls." These may naturally be classed under one head. The leading idea intended to be disseminated under this fifth objection, is, that on Mr. Ellet's reservoir plan the first cost will be less, the maintenance less, and the tolls nothing.

Having advocated the improvement of the Ohio River as a national work, and presuming that it may be thus effected directly or indirectly, the writer cannot perceive the point of difference so far as *tolls* are concerned. If the government expends $20,000,000, in constructing, repairing, and managing artificial reservoirs for making an artificial river, and is not to charge citizens using the same any tolls therefor, why should the same government expending ten or twelve millions in constructing a slackwater improvement charge any tolls for the use thereof? Is there any *principle* in one case not involved in the other? Whether it will cost more to maintain and manage the slackwater than it will to maintain and manage reservoirs, is a point yet to be determined. But if it should be proved likely to cost more, that could only affect the *rate* of tolls, not the principle of charging tolls.

The first cost of a slackwater has been variously estimated by its friends at six to twelve millions of dollars; by its opponents at ten to twenty-five millions. Some have set down ten millions as necessary for "auxiliary reservoirs," for slackwater purposes. But this last item must be regarded as very extravagant in view of the claim, that it would cost less than two millions to furnish water enough to keep up the flow on the entire natural river to a five feet stage, all the year round, as estimated by Mr. Ellet, and approved by Mr. Morris. Surely, it ought to cost much *less* than two millions for any possible imaginary need for slackwater use! Why a five feet flow, according to the calculations, affords 864,000,000 cubic feet in 24 hours. Now a lockfull, of the largest size, as already shown, is but 182,000 cubic feet, and allowing a lockage every 2½ minutes, or 24 lockages per hour, or 576 per day, it would be but 104,832,000; leaving 759,168,000 cubic feet, or a flow equal to more than 4 feet depth over the Wheeling bar, for the evaporation and to leak through the dam—a most extravagant assumption, certainly.

Does not this show to the candid inquirer, that the expression "ten millions of dollars for auxiliary reservoirs," is made entirely at random? This incongruity is glanced at without for a moment admitting that there can ever be any necessity for reservoirs of any kind for the lock and dam navigation. In continuation of the thought in connexion with the lockages just assumed, look at the aggregate result it would give! Allowing an average of but 500 tons to each lockage, it would be 288,000 tons per day, and for 340 days per annum, *one hundred and twenty-nine millions of tons;* an amount perhaps *ten times* greater than may be expected for some years to come.

Under the head of this fifth objection, relating to the "cost, maintenance, and tolls," it may be proper to enter somewhat into detail. Is it very difficult to make a reliable estimate of what the slackwater improvement ought to cost? As an engineer, the writer is constrained to answer that it is one of the simplest problems that could be presented to those members of the profession who have had experience in constructing river locks and dams. Except as to the damages that may be caused by actual overflow from backwater, the items are such as admit of an easy solution. Mr. Morris, including ten millions added for auxiliary reservoirs, adopting Mr. Ellet's random estimate of twenty-five millions, assumes thirty-five millions as the probable cost, and then proceeds to say, "even this great sum will not appear large to those civil engineers who reflect that such works as would be necessary to control this mighty river—constructed upon the dangerous gravel bottom which forms its usual bed—have never yet been executed in any country."

To warrant this there must have been something contemplated which has never entered into the calculations of the writer. He has only thought of carrying out very much such plans as he has carried out successfully before. The Monongahela River, in its natural state, as surveyed in 1838, was too nearly like the Ohio River in its present condition, to render such language applicable to one without being almost equally applicable to the other. The average fall in the Monongahela

below Brownsville, was seven inches per mile; the fall in the Ohio between Pittsburgh and Wheeling, is about ten inches per mile, and between Wheeling and Cincinnati, $6\frac{3}{4}$ inches per mile. There is not difference enough in the natural declivity to base any strong argument upon; and on an average, what difference there is, is in favor of the Ohio River. Secondly, the bed of the Ohio is as much like that of the Monongahela in its characteristics, as any similar distance on the Ohio is like any other part of itself. On each river rock bottoms sometimes occur, but generally the foundations will be gravel, not *sand* in any case—the gravel being of precisely similar general character. Thirdly, the very high floods on the Monongahela had risen to about the same elevation as those on the Upper Ohio—over 30 feet above low water. True, at Wheeling the Ohio has risen 45 feet, and at Cincinnati 63 feet above low water. It is yet to be decided whether this will operate for or against the system of locks and dams, as proposed. If our proposition was, as figuratively expressed, to "bridle" the river, the fact that the Ohio River rises higher than the Monongahela, might have an important bearing; but as no such thing was attempted on the Monongahela, it is not proposed on the Ohio. On the contrary, instead of "bridling," every arrangement consistent with the convenient management of the locks was made, to afford the floods a clear sweep. The lock-walls were designed to be only of such height that when the navigation over the dams should be safe, they would be submerged, and the locks for the time being would not be used. What essential difference will it make, whether they be submerged with 20, or 10, or 5 feet depth of water? Fourthly, the dams on the Monongahela below Brownsville, are 15 feet high above the bed of the river, and above Brownsville 19 feet. Those on the Ohio are not to exceed 14 feet. The longest dam on the Monongahela is 1300 feet. After deducting the space occupied by the double locks, it is thought that those on the Ohio will not average over one-fifth more or 1560 feet. Fifthly, the large locks on the Monongahela are 250 by 55 feet; it is proposed that the locks on the Ohio shall not exceed 350 by 65 feet. The difference is mainly a question of cost, involving no peculiar engineering problem. Locks as large as the largest yet proposed for the Ohio, have been built on the ship canal of Sault St. Marie, below Lake Superior.

What then is it that is to be encountered on the Ohio that has not already been met and overcome by American engineers? The principal difference between the regimen of the Monongahela and Ohio Rivers, arises from the greater height of the floods on the middle and lower portions of the Ohio. The locks will be more frequently and longer submerged. On the other hand, the dams being one foot less in height, the river over them will become boatable a little sooner than on the Monongahela, and will continue so for longer periods. There are some advantages as well as disadvantages in having the locks submerged. So far as the dams alone are concerned, the lower they are the better; but in connexion with locks we must take care not to increase the number unnecessarily. As low water periods cover about one-half the boating season, it will probably be found that the height already suggested, 8 feet from pool to pool, is convenient and proper.

We will then assume that we have to estimate the cost of a double lock 350 by 65 feet chamber, with 8 feet lift, and a dam 14 feet high and 1560 feet long. We assume substantial rubble stone work for the lock walls and abutments, and timber cribs filled with stone for the dam.

Estimated cost of one Dam and two Locks, including chute in Dam.

Foundation excavations, 1000 cubic yards at 75 cents,	$ 3000·00
" " 5000 " 25 "	1250·00
Abutment masonry, 1500 " $6,	9000·00
Crib timber, 7500 feet lineal, at 15 cents, . .	11,250·00
Upper covering, 170 000 feet B. M., at $20, . .	3100 00
Lower " 40,000 feet lineal, at 15 cents, .	6000·00
Sheet-piling, 50,000 feet B. M., at $20. . .	1000·00
Iron, bolts, spikes, &c., 75,000 lbs. at 10 cents, .	7500·00
Stone filling, 24,000 cubic yards, at 80 cents, . .	19,200·00
Excavation of foundations, 7000 cubic yards, at 75 cents,	5250 00
" " 4000 " 25 " .	1000·00
Feet lineal of timber, 3600 " 15 "	5400·00
" B. M. plank, 264,000. at $20, . . .	5280·00
" " sheet-piling, 15 000, at $20, . .	300·00
Pounds of iron, bolts, &c., 22,000. at 10 cents, . .	2200·00
Cubic yards of lock-walls and head-wall, 10,200, at $7,	71,400·00
Gates and fixtures, ...	20,000·00
Lock house, ...	1000·00
Chute in dam, ...	12,000·00
	$185,430·00
Add for contingencies and engineering, 10 per cent.,	18,543,00
	$203,973·00

Allowing that the entire length of the Ohio River should be embraced, requiring 50 dams, it would make a total of $10,198,650.

In round numbers, ten millions of dollars, not including damages that might be caused by overflow ; which, however, is not likely to be a very heavy item. We may reason, *a priori*, from the fact that the Ohio River is *at all times* subject to floods rising 40, 50, and even 60 feet above the ordinary stage, that there cannot be a very great amount of property exposed to injury from an overflow which averages but ten feet, and no where exceeds fourteen. Experience on the Monongahela River confirms this view. The damages alluded to will not probably constitute a large or controllihg item. It is true that a careful examination will be required to determine accurately what it may amount to, but we may apply some judgment respecting it in advance. In the opinion of the writer, a total cost of eleven millions of dollars will cover the entire improvement including damages.

Cost of Maintenance per annum.

1 general superintendent, . .	$ 5000·00
3 assistants, at $1500, . . .	4500·00
9 foremen. " 600, . .	5400·00
90 hands, " 400, . . .	36,000·00
100 lock-tenders, 300, . .	30,000·00
3 steam tows, interest rent, . .	15,000·00
6 flats, " " . .	1200·00
Materials, ...	10,000·00
Total,	$ 107,100·00

Being about one per cent. on the original cost.

And even if the government should provide for 6 per cent. per annum in addition on the gross cost, and charge all to the improvement, the total per annum would be but $767,100.

What rates of tolls would it be necessary on this assumption to charge to cover all? If we take the aggregate *value of the business* to be accommodated on a complete navigation at $400,000,000, it would be less than two-tenths of one per cent.—less than two mills on the dollar of value!

And what would be the saving to merchants, manufacturers, farmers, and all consumers? It would be many millions of dollars in insurance. In absolute saving from destruction of thousands not insured, including an immense amount of coal now annually lost. In increase of profits from increase of business with less invested capital. In saving of interest on great quantities of produce and manufactures which now lie worse than idle for months. In the certain and general increase of all descriptions of business along the Ohio River valley which must follow the completion of such a reliable navigation.

The annual saving in insurance alone, will go far towards covering the entire aggregate.

Next, in regard to the coal trade: it has been stated by intelligent gentlemen familiar with the coal shipping business of Pittsburgh, that the annual loss in various ways, is about 20 per cent. of all that starts to go down the river. On the limited amount of one million tons, this would show an actual loss of 200,000 tons, which at an average of $4 per ton for the value down the river, would be $800·000; which is more than the whole toll required to cover interest on cost and maintenance of the improvement. But with such an improved river we shall have *three millions* of tons almost immediately upon its opening—thus presenting an annual saving fairly to be considered of $2,400,000 on the single article of coal. Nor is this all. There is now a heavy expense attending the coal business, which would be entirely cut off, namely, watching and bailing coal arks while waiting days, weeks, months, sometimes almost half a year, for a rise in the Ohio to take them out. The great amount of dead capital which must now be invested in consequence of this mode of doing the business is a serious clog upon its progress.

It is well known that some of the finest coal fields in the world are to be found between Wheeling and Pittsburgh, and along the tributaries above, and that the cities below on the Ohio and Mississippi consume large quantities from that region, and would consume *much more* could the supply be made certain and regular, with a reasonable regular price instead of a fluctuating scale varying from 12 to 40 cents per bushel. There has not yet been discovered along the Lower Ohio or Mississippi Rivers, any coal comparable to the Pittsburgh seam for gas purposes. Applying the calculation to only one and a half millions of tons of coal per annum, which is equal to 42 millions of bushels, a charge of one cent on the thousand miles of the Ohio River would be $410,000—a charge that would be saved to the coal interests several times over any year. And this is but one branch of the great aggregate trade upon

which this merely nominal tax would be distributed! It is not too much to assume that the entire cost of carriage of the coal on the improved navigation will be less than the present annual aggregate losses and extra charges. But this is not the place to enter into further detail in relation to this important question. In due time its investigation will doubtless be fully made.

The receipts on the 55 miles of Monongahela navigation in 1852, were $62·666, or an average of about $1340 per mile. The same business at similar low rates per mile on 1000 miles of the Ohio improvement would be $1,340,000. It cannot be questioned that the general business on the Ohio will be very much greater, and the tolls may thus be kept down to still lower rates.

Mr. Ellet in treating this branch of the subject, emphatically remarks: "It is scarcely to be doubted that the maintenance of a depth of 5 feet in the Ohio alone, at all seasons, would save the country from an annual tax upon its present business [7 years ago,] of five millions of dollars." It is evident that the rates of toll on the Ohio slackwater can be made lower even than they are on the Monongahela; and they are less on that improvement than they are on any other public work in the United States. The average on classed freight is about 5 mills per ton per mile, and on coal about 2 mills.

From the foregoing data we think it is shown, that the original cost of the slackwater, cost of maintenance, and the rates of toll that may be deemed necessary, do not constitute startling objections to the slackwater as a system. No radical improvement of so large a stream can be accomplished without considerable cost; the real question is, can it be effected in any cheaper or better manner?

6. *The sixth objection is,* "that the pools will fill up with sediment." This has been answered more than once, but at no time more beautifully than in the communication of Josiah Copley, Esq., to the Pittsburgh Board of Trade, dated January 15th, 1856. He says, "apprehension has been felt and expressed by some persons, that in time these pools will fill up more or less with sand and mud, and the channel be rendered too shoal for navigation; but these fears are groundless." * * * "On the Ohio, the inclined plane will be restored whenever the water raises to a height above 16 feet above the ordinary low water line; and that being the case, the velocity of the current will be the same as if no dams existed; for the water will be urged onward, in obedience to the law of gravity, with all the speed due to the natural fall of the river, just as it now is. This being so, its power to sweep its pools will be unimpaired, and consequently the debris cannot be deposited any more than it is now. In their natural condition, the Allegheny and Ohio are but a long series of alternate *dams* and pools—the ripples, as we call them, being nothing else than natural dams. The intervening pools or "eddies," as they are generally though improperly termed, are frequently thirty feet deep at the lowest water; yet the floods sweep them out, and they indicate no appearance of filling up.

"It is only in streams so small that no floods can ever restore the inclined planes broken by dams that we find pools filled up with debris. They never rise sufficiently high to restore the original velocity of the

water in the portions of their channels occupied by these artificial pools; the consequence is, that whatever sand and mud are carried down from above, are deposited in this slackwater and remain there. In time the channel becomes so contracted, both in breadth and depth, that the stream in times of freshets, acquires its original velocity. After that no more sediment is permanently deposited.

"The Monongahela pools furnish a confirmation of the truth of the position here taken." And, it may be added, so do the pools of the lower Lehigh, the Juniata, the Kiskiminetas, the Beaver, &c. This objection appears to have no practical foundation. If it were applicable at all to any dams yet proposed on the Ohio or Allegheny, it might have some force against those very high dams designed by Mr. Ellet to form a part of his artificial reservoir system, where the height of the dam would exceed the greatest natural rise of the stream, not permitting the river at any stage to be restored to its natural inclined plane, and where for much of the time these immense pools would be comparatively still. But even in this case the writer regards the objection as futile. Almost universal experience teaches, that no difficulty from this cause could arise on the Ohio River with pools of only eight feet lift, and floods of more than 30 feet height.

(To be Continued.)

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*On the Disturbances of Suspension Bridges, and the Modes of Counteracting them.** By Messrs. A. S. Lukin and Charles E. Conder.

This Paper brought under consideration the various kinds of suspension bridges, and examined their greater or less liability to undulations of the roadway, and other disturbances, occasioned by a traversing load, or other causes.

These disturbances were attributed chiefly to the flexibility of the chains, and were enumerated as follows :—

1. Undulations caused by traversing loads.
2. Reaction on the roadway of the chains when set in agitation.
3. Transverse swing.
4. Distortions caused by the gravitating tendency of the chains.
5. The effect of unequal loading in bridges of multiple spans.

The first class of disturbances might be reduced by increasing the mass of the chains. The objection to this was that not only would such an expedient prove wasteful of material, but the greater the weight of the chains the greater the danger of their destroying the platform, if once set in agitation. Again, the roadway might be supported by a rigid girder, strong enough to withstand any distortion of the chains. Such a girder would, however, be nearly strong enough to carry the load independently of the chains, which would become dangerous auxiliaries to an inflexible platform.

The Niagara Suspension Bridge was adverted to, as having its liability to undulate much reduced, not only by connecting the upper and lower platforms with lattice trussing, but also by employing strong upper and under bracing rods.

* From the Lond. Artizan, July, 1857.

It was contended, that while a certain degree of stiffness in the platform would be advantageous, as equalizing the distribution of the load on the chains, the main point for inquiry must be the arrangement of chains and rods best calculated to abate the liability to disturbance.

With this view six modes of arrangement were described and illustrated, viz:—

1. The ordinary suspension bridge.
2. The mode of suspension by a double set of crossed chains (Russel's).
3. The single rod direct suspension.
4. The chain with slanting rods (Dredge's).
5. The double rod direct suspension.
6. A new mode, distinguished as the convergent suspension, of which two varieties were exhibited and explained, by means of diagrams and models.

1. It was pointed out, that while the ordinary form of suspension bridges effected a marked economy of material, its great flexibility and liability to undulate and swing, operated against its employment for railway traffic.

2. The mode of suspension by crossed chains (as in Mr. Russell's bridge), while tending in some degree to reduce these disadvantages, required an enormous increase of material, together with a double height of tower.

3. It was stated that the single rod direct suspension, while perfect in theory, as regarded freedom from undulation, was defective, owing to the length required for the rods, the sharp angles at which they met the roadway, and their consequent liability to stretch and "sag."

4. The introduction of a chain to support the slanting rods (as in Mr. Dredge's bridge) diminished these evils and shortened the rods, at the same time that it secured a more equable distribution of the tensions. But this arrangement, in common with the preceding mode of direct suspension, imposed powerful horizontal strains on the roadway; and the excessive strength thus demanded in the platform, militated against economy, if it did not even impair the safety of the whole structure.

5. The double rod direct suspension entirely relieved the platform from any horizontal strain. But the great length and angle of its extreme rods entailed and increased all the other evils to which the single rod direct method was exposed.

6. The convergent mode of suspension was devised to avoid, as far as practicable, the several defects which had been pointed out in the five arrangements abovementioned. From a double set of chains (each extending from the top of one tower to the platform level at the opposite extremity), a double set of rods were suspended, slanting in opposite directions, so that a pair of rods converged to every point by which the platform was suspended. There was thus an entire absence of horizontal strain on the roadway, which might, therefore, be made of extreme lightness, while the advantages of direct suspension would be to a great extent secured, the undulations of the roadway and the tendency to lateral swing being reduced to a minimum; and the reaction of the

chains on the platform would be much diminished by the radiating play of the rods. It was shown, by means of tables, that the convergent principle admitted considerable economy of material. Two designs were exhibited, the second of which, although theoretically inferior to the first, effected a great saving in the weight of the chains, by allowing a sharper curvature. At the same time it was submitted, as a matter worthy of inquiry, whether an application of the convergent method might not be arrived at still better suited for large spans.

A mode was suggested of connecting each pair of rods with the platform, by means of a self-adjusting lever, the play of which, by equalizing the horizontal strains, would tend to diminish the derangements caused by an unequally distributed load.

It was pointed out that the gravitating tendency of the chains would cease to operate, as a source of disturbance, if their sectional weight were so adjusted (by ballasting or other means,) as to cause them to hang naturally in the curves due to the conditions of suspension.

The effect of unequal loading in bridges of multiple spans was then adverted to, as giving rise to danger, through the unequal tensions induced in the chains on opposite sides of a tower. A table was given, showing that the employment of convergent rods reduced this danger to some extent. Inverted chains below the platform were also advocated in bridges of multiple spans designed for railway traffic.

The mathematical reasoning and formulæ upon which the foregoing conclusions were based, were not considered suitable for reading aloud, they were therefore given separately in an appendix.—*Proceed. Inst. Civ. Eng.*

For the Journal of the Franklin Institute.

On Joints for Railroad Bars. By A. C. Jones, Engineer.

In the recent discussion on joints for railroad bars, I believe that there was no mention made of the injury to the joints, resulting from the common method of making a curve to consist of a series of short chords by each length of rail being laid straight, or if sprung to a curve, its stiffness aided by the running of the trains, soon brings it to a straight line; from a personal inspection of tracks, almost continuous from Massachusetts to Alabama, I found that scarcely any attention has been paid to this point, and yet at a glance of the diagram, it will be seen that there is a side thrust from the flanch of each wheel, aiding the vertical pressure to loosen the joint and chair.

Persons having been on the platform of the old four wheel locomotives, when running, may remember the unpleasant side twitch from this cause; the flanches hugging the straight rail by the centrifugal force, runs its

length to the end of the next, there to be changed from its tangential course, and so on the next length until the curve is run. This is not now so perceptible with the *truck*, but still it is an element of destruction, and is one cause of trains leaving the track.

The proper mode is to curve the bars before laying them. The expense of curving the bars is not great, for during my connexion with the New York and Erie Railroad, as many as five hundred (20 feet) heavy bars were curved each working day in midwinter, by two laborers operating on a curving bench, the rail being brought to it by assistants.*

All persons traveling on railroads where chairs are in use, have noticed the disagreeable rattling consequent to the play of the bars in the chairs. As early as 1834, it attracted my attention, and I suggested a plan for obviating it, but it was not until 1840, that I had an opportunity of proving it myself. I took a few chairs (Stephenson's iron keys), and recessed them about $\frac{1}{4}$-inch, leaving a chipping piece at each end, when the chairs were in place without the keys, the recesses were filled with metallic lead, (hard from having been melted many times,) and although this was a part of the track which was used both ways by a large traffic, yet during the five months it was under my notice, there was no "spewing out" of the lead, and the noise was slight compared with the keyed chairs.

Many of the wrought iron chairs exhibited at the meeting, having been fitted nicely to the individual bar, left nothing to be desired for fit, but in providing for a long line of road it would be different. Now, instead of this attempt at perfection which will enhance the cost of the chairs, they are "set in" at the ends and middle of long chairs, and the spaces between the bar and chair filled in with fusible metal; you have as perfect a fit as it is possible to make and at a small cost. There are many alloys melting at a low temperature, which when set, are nearly as hard and tough as wrought iron. When the bars are wished to be held endwise by the chairs, a piece of iron inserted in the holes will be kept by the alloy in place.†

Allusion having been made to the difference between the wear and tear of the rails on an unyielding superstructure and one that is springy, it may not be out of place to record the following. The Portsmouth and Roanoke Railroad, (built by Major Walter Gwynn,) runs over a portion of the Dismal Swamp, which consists of a turf-like substance ten or twelve feet thick, over-lying a semi-fluid material composed of fine sand, mud, decayed vegetable matter, and water. The weight of a person jumping up and down on its surface will produce a wave, which will cause another person many yards from the first also to rise and fall. This was the condition of the foundation for the road way, and the superstructure was made of split-rails (similar to the farm-fence,) laid crosswise two feet in thickness, and about two feet of earth on top, and then the sills or ties as usual; on each side ditches were made, which always

* Full particulars may be obtained by referring to my article on this subject published in this *Journal*, Vol. ii. 3d Series, p. 23, 1841.

† The proper place to secure the bar to the road-bed for expansion or end thrust, is at its middle either by a chair or notch and spike.

remained full of the dark-colored water of the swamp. This piece of road gave great trouble to keep in order for eight or ten months, until the interstices of the split rails had become filled and all consolidated, and afterwards this was the smoothest and best part of the track.

On another part of this road, in 1835, before the truck cars were in use, I tried an experiment on a straight level part, by painting the surface of the flat bars, and then had the train run over them at a speed of 40 miles per hour; the paint midway between the ties was not touched, the wheels actually jumping from one tie nearly to the next one, and this was the case on both sides of the track as far as painted.

Believing that the chair and rail should be of the same metal, I propose a "clamp chair,"* (see sketches,) which is easily made, and involves no extra labor to be done to the ends of the bars; it has vertical and side stiffness, combining most of the good qualities of the "side fish," under plate, and T form, without requiring the rail bar to be drilled or punched, nor rivets or bolts to secure it to the rail; it may be long enough to suit a single cross-tie, figs. 1 and 2, or for two ties with the joint of bars between fig. 3. The chair by either method of fastening will be held firmly to the ties and bars, and yet it admits of being quickly removed when required.

Fig. 1.

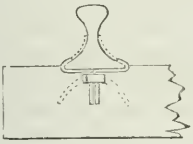


Fig. 2.

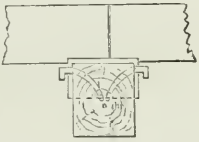
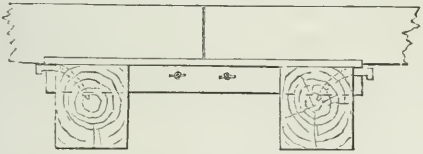


Fig. 3.



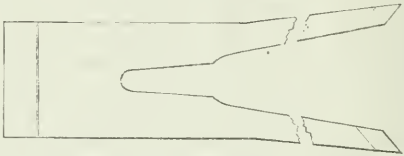
Angle iron of a suitable length is bent on one edge so as to hook over the bottom web or base of the rail bar, and at each end a small piece is punched out, so that when two of these plates are placed with their straight flanches together, these square notches receive the head of a wedge-shaped staple, which clamps the two side plates on the base of the bar and at the same time fastens all to the cross-tie.

The part of the chair hooking over the bar could be extended up the stem, as shown by the dotted lines, fig. 1, but this would enhance the cost of making and fitting without commensurate benefit, as ¾ths to one inch

* This and its fastenings, will be referred to the Committee on Science and the Arts, to be reported on.

hook is ample for the purpose. The staple (fig. 4,) is made of wrought iron, the head suiting the notches in the chair; it has a hook on one side to facilitate its withdrawal from the tie after it has been driven in it, the "tines" are about 4 inches in length, and only differ from a square spike by the end being bevelled *diagonally*, like an engraver's tool; the only part requiring accuracy is the V form of the inside; this should be closer at the narrow part than the two thicknesses of the vertical flanches of the chair.

Fig. 4.



The wooden cross-tie having been prepared for the reception of the chair, the two plates are slipped along the rail until in position on the tie, and the staples (previously slightly bent in the direction of the point,) are driven into the sides of the tie, and the diamond-shaped points will cause the tines to pass in curves downwards and endwise towards the heart of the tie, spreading more and more until home; the stiff jaw of the head grasps the two parts of the chair in the notch, drawing them close together, and the hooked edges on the wedge-shaped base of the rail secures it to the chair. All are held firmly to the tie by the head of the staples in the notches of the chair.

The two parts of the chair when fitted to the bar should have a clearance between to suit variations in bars, to allow of compression and the springing of the parts. If thought proper, a thin slip of wood could be placed between the two flanches below the staples.

It will be readily seen that the inside surfaces of the staples exert a great force to draw the two parts of the chair together, that the staple is prevented receding by the clinched form of its tines, and that the running of the trains cannot draw out the staple, as any force applied to the rail only acts on the *side* of the head in the notch of the chairs.

Fig. 5.

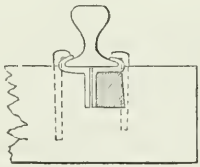


Fig. 6.

To withdraw the staples from the tie, a wedge-shaped tool is driven between the hooked head of the staple and the ends of the chair, and the staple drawn out; the plates forming the chair being pushed endwise, the two ends of the rail bars are set free.

In long chairs with the rail joint between the ties, two keyed bolts (fig. 3,) may be used along with the staples at the ends.

Another mode (fig. 5,) of securing the chair to the bars and ties, is to take the lengths of angle iron, and instead of notching at the ends, make two notches in the hooked part; the jogs in the ties are made to suit a key made of hard wood passing outside of the vertical flanches of the chair. After this key is driven tightly in both cross-ties, the chair is held down by the usual hook-headed spikes in the notches, and the key prevented working out.

Staples and spikes may be dispensed with, by making the straight web of the chairs to hook under, (fig. 6,) forming a half "dove-tail," and the key driven alongside as before; the key could be prevented working out by a single nail driven in its side.

AMERICAN PATENTS.

List of American Patents which issued from June 30th, to July 28th, 1857, *(inclusive,) with Exemplifications.*

JUNE 30.

246. For an *Improvement in Fountain Lamps;* Henry Wright Adams, City of New York.

Claim.—"Providing the burner cup with an internal cylinder or lining, to leave an open bottomed but close topped passage around the burner in communication with the tube or passage coming from the fountain or reservoir, said internal cylinder or lining being provided with an opening opposite the tube or passage."

247. For an *Improved Smelting Furnace;* Charles C. Alger, Newburgh, New York.

Claim.—"An improved furnace, that is, with its hearth or crucible and boshes of an elliptical or elongated form, in combination with the two mouths (one at each end for working and tapping), and two or more tuyeres at each side, so arranged as to introduce the blast in the direction of the breadth."

248. For an *Improved Machine for Making Bolts and Rivets;* Joel R. Bassett, Cincinnati, Ohio.

Claim.—"1st, The clamps constructed and arranged on the periphery of a rotating stock, in such manner as to be readily accessible for inspection and replacement, in combination with the friction roller for the clamping and releasing of the bolt or rivet. 2d, In combination with the above, the yielding rest and divided cutter, by means of which the rotation of the clamp stock severs the blank, the end of the rod being contracted during the act of separation, and afterwards released by the retraction of the rest and cutter. 3d, The arrangement of heading dies and adjustable stationary cam, in combination with the clamps and the perpendicular face of the plate."

249. For an *Improved Machine for Riveting Boilers;* Silvester Bennett, New Orleans, Louisiana.

Claim.—"The employment, in combination with the riveting punch or plunger, of a hollow 'set' fitted to slide upon the exterior of the same, and operated to close or set the metal around the rivet before the operation of the punch or plunger commences, and hold the same closed during such operation."

250. For an *Improvement in Iron Pavements for Streets;* George W. Bishop, Brooklyn, New York.

"The object of my invention is to make a pavement for streets of blocks of iron, so formed on their upper surface as to effectually prevent horses from slipping, and permit

water with accumulating dirt to run off to the side gutters, and at the same time of securing rails thereto for a railroad."

Claim.—"Making cast iron paving blocks with a series of transverse draining grooves, which when completed and laid, will form grooves running from the middle of the street towards the side gutters or sewers. Also, forming the surface of iron paving blocks with a series of inclined planes and shoulders, to prevent horses from slipping, while at the same time carriages will roll over the surface without serious impediment or concussions. Also, the said series of inclined planes and shoulders, in combination with the lateral grooves for draining, but which also answers the purpose of preventing horses from slipping. Also, the manner of uniting the iron blocks in laying a pavement by the alternating over and under lapping of the series of blocks, whereby the blocks are enabled to sustain one another, and thereby more effectually maintain the required grade."

251. For an *Improvement in Machines for Making Paper;* Edward B. Bingham, Brooklyn, New York.

Claim.—"The employment or use of the endless aprons, one or more, placed within the pulp vat adjoining the cylinder."

252. For an *Improved Blast Blower;* John Brough, Aurora, Illinois.

Claim.—"The wind or blast wheel, constructed of the circular plates, having openings made through them, and provided with hoods, the plates having a bucket or piston, one or more, secured between them, when the wheel thus constructed is fitted within the fan box constructed in the form of a scroll."

253. For an *Improved Machine for Making Horse Shoes;* Henry Burden, Troy, New York.

Claim.—"1st, The feeding apparatus, and in connexion therewith the mode of cutting off the rod; also, the self-acting device for stopping the feeders, and the mode of renewing their action at the proper time. 2d, The mode of bending the rod and placing it in its proper position between the swaging dies. 3d, The flanch on the upper swaging dies. 4th, The combination of the revolving, creasing, and punching die, with the revolving swaging dies, by which both operations are successively and automatically performed. 5th, The devices for taking the shoe from the upper, and confining it to the lower dies, and finally taking it from the lower dies and conducting it to the flatener. 6th, The means for flatening the shoe. 7th, The combination and arrangement of machinery by which the several processes are performed successively by one machine, and without aid from attendants. Also, those devices, or their equivalents, which shall effect the same."

254. For an *Improved Portable Steam Radiator for Heating Apartments;* I. H. Chester, Cincinnati, Ohio.

Claim.—"The portable radiator constructed with plain inner surfaces, the deflector, boiler, and tube."

255. For an *Improvement in Distributing Apparatus of Flouring Mills;* Alfred T. Clark, Lancaster, Pennsylvania.

Claim.—"The double series of spouts and valves, arranged and connected with the bolting chamber. Also, the arrangement of the conveyer, in combination with the double series of valves and spouts."

256. For an *Improved Whiffle Tree Hook;* Anthony Cooley, Paw Paw, Michigan.

Claim.—"Providing the outer extremity of the hook socket with an open slot and spring seat, and fitting the feather spring and the shank of the snap in the same. Also, furnishing internally each of the cheek-pieces of the open slot of the hook socket, with a scroll slot, and the snap with two short journals, and fitting these journals in said slots, and holding them in place by means of the feather spring."

257. For an *Improved Earth Excavator;* Curtius Colby, Wilson, New York.

Claim.—"1st, The use of the levers with their combination. 2d, Suspending the arms to the frame at a point above the level of the top of the excavator, thus securing the elevation of the hind as well as the fore part at the same time. 3d, Causing the return of the bottom of the excavator to its proper position for reloading by means of the strap and roller."

258. For an *Improvement in Uterine Supporters;* W. E. Cooke, Philadelphia, Pa.

"This invention is to relieve and permanently cure 'prolapsus uteri,' and the other diseases consequent thereto—and the nature of the invention relates to the manner in which the supporter and truss is made self-adjusting or self-yielding to the body of the wearer in all material parts."

Claim.—"The manner of uniting the bars to each other, and to their pads respectively, through the intervention of the sides or hip bars, so that the truss and supporter may not only be adjustable, but also self-adjusting to the person or body of the wearer. Also, in combination with the front pad, an adjustable pessary."

259. For an *Improvement in Gas Regulators;* John H. Cooper, Philadelphia, Penna.

"My invention relates to improvements in that class of gas regulators in which a valve, spring, and inverted cup are used, and my improvement consists in so connecting the inverted cup and valve to an arm hinged to the interior of the instrument, that its sensitiveness is increased by avoiding the objectionable friction common to ordinary gas regulators."

Claim.—"The combination of the inverted cup, arm, and valve, when both valve and cup are attached directly and permanently to an arm hinged to the interior of the casing."

260. For an *Improved Horse Shoe;* Wm. Cooper, Brooklyn, New York.

Claim.—"The use of a metallic plate horse shoe covering the base of the hoof, having a suitable stopper fitting into a screwed opening in the same, or an equivalent therefor."

261. For an *Improvement in Gas Burners;* Asa D. Gates, Binghampton, N. Y.

Claim.—"Attaching to the top of, or slipping over the usual burner the conical or cylindrical supplemental chamber burner."

262. For an *Improved Apparatus for Separating Oily Particles held in suspension by Steam;* Robert Hale, Roxbury, Massachusetts.

Claim.—"The apparatus for separating oil from steam."

263. For an *Improvement in Harvesters;* Henry D. Hammond, Batavia, New York.

"The invention consists in a peculiar combination of devices for the simultaneous turning up of the teeth of the harvesters, and the elevation of the side of the machine towards the standing grain."

Claim.—"The shaft with arms relatively attached thereto, in combination with the swinging flanched supporting bar, and the journaled cutter and finger bar, connected with arms, when said parts are arranged for joint operation."

264. For *Improved Adjustable Fender Posts for Saw Mills;* Henry Harpold, Racine, Ohio.

"The invention consists in constructing the fender posts in saw-mills in such a manner that the slides may be so varied as to give the saw any desired pitch, and also that when the saw has worn, hollowing in the centre, the frame may be so adjusted as to accommodate itself to the shape of the saw; also in the arrangement of the jaws."

Claim.—"1st, The fender-posts arranged in two parts and adjustable, secured together by hook bolts, and working on a pivot on the fender beams. 2d, The jaws and blocks attached to the saw sash, and working on a swivel arranged with the adjustable fender posts, for the purpose of giving the saw pitch and making it follow a desired curve."

265. For an *Improvement in Harvesting Machines;* John K. Harris, Allensville, Indiana.

Claim.—"Imparting to the cuttter bar of harvesting machines, a uniform reciprocating motion by means of the duplex drive wheel, when used in combination with the rocking pinion, said wheel and pinion being geared by means of alternate and oblique sets of cogs."

266. For an *Improvement in Electric Telegraphs;* Harrison G. Dyar, City of New York; patented in England February 3, 1851.

Claim.—"Constructing and operating signalizing telegraphic apparatus in such manner that electric pulsations representing signals resulting from the actions of two or more operators at work at the same time, are imparted alternately and successively to a

single main conductor or wire of communication, and received therefrom, and distributed in the same alternating succession, whereby a single main conductor may be made the instrument by which two or more operators can be simultaneously employed in sending different messages either in the same or in opposite directions. Also, transmitting different electric signals, resulting from the actions of two or more operators, working at the same time, at the same or opposite ends of a single main conductor, by means of a single main conductor, combined with two or more sets of corresponding signal sending and signal receiving conductors, which represent the different signals in use, and are appropriated to different operators by means of intermediate circuit making and circuit breaking apparatus, which are moved in harmony at the signal sending and signal receiving stations, in such manner as to present themselves successively in all the positions required to permit currents of electricity to be passed alternately through the corresponding members of the signal sending and signal receiving conductors, whereby the apparatus at each station can at the same time be employed in transmitting and receiving signals representing messages. Also, transmitting electric pulsations to a main conductor, and distributing them from the same main conductor by two sets of circuit making and circuit breaking apparatus, which are moved in harmony with each other, but are moved by the mechanism independently of the other portions of the telegraphic apparatus, in such manner that the harmonious movement of the circuit making and circuit breaking apparatus at either end of the main conductor is not impeded or controlled by the irregular movement of other parts of the telegraphic apparatus. Also, sending and receiving signals, as above stated, by apparatus, so arranged and combined with the main conductor that in operating the impulse that closes or opens the circuit shall last but a moment, while the contact maintained at the station where the signal is received shall last a longer period, so as to obviate the necessity of exact synchronism in the movements of the mechanism at the two stations."

267. For an *Improvement in Sewing Machines;* Elias Howe, Jr., Cambridge, and Wm. R. Bliss, Boston, Massachusetts.

Claim.—"1st, In connexion with the mode of forming a seam by means of two threads, the seizing and holding of the loop of the needle thread after it is inserted by means of the point of the shuttle and finger, or their equivalent, and the withdrawing of the needle from the material to be sewed before the shuttle thread is passed through the loop. 2d, The combining and arranging of the mechanism which works the shuttle thread and the baster, or its equivalent, with the standard, and in connexion therewith so arranging the mechanism which works the needle thread, as that they shall co-operate and form the seam when the standard is inserted in objects of a tubular form."

268. For an *Improved Permutation Lock;* Frank G. Johnson, Brooklyn, New York.

Claim.—"The combination together of the tumblers (using two or more of said tumblers) with the exterior pins, and the pins with the springs, the bolt, and locking latch."

269. For an *Improvement in Metallic Packing for Steam Pistons;* Daniel Lasher, Brooklyn, New York.

Claim.—"The manner of constructing the bent or folded metallic springs to take an even and extended bearing on the inner side of the packing ring or rings, when provided with the lips or projections, to keep the springs properly in place."

270. For an *Improvement in Iron Truss Frames for Bridges;* Francis C. Lowthrop, Trenton, New Jersey.

Claim.—"The straining plate, in combination with the rods, when the latter are connected to the plate, and when the said plate is arranged to receive the vertical or verticals and diagonals of iron truss frame bridges."

271. For an *Improvement in Self-acting Rakes for Harvesters;* Salem T. Lamb, New Washington, Indiana.

"The invention relates to the construction and peculiar operation of a self-acting raking apparatus."

Claim.—"In combination with a rake having the motions, the gyratory beam, and the rock shaft, when the rake is attached to said rock shaft. Also, in combination with a rake operating the slotted guard for regulating or governing its motions, when combined with the beam and shaft. Also, in connexion with a rake having the motions, the combined use of the spring for holding it to its work, and the set screw for regulating the extent of descent of said rake."

272. For an *Improved Sawing Machine for Felling Trees;* Matthew Ludwig, Boston, Massachusetts.

Claim.—"The combination of the vibrating radius with the pitman and saw-stock, for the purpose of guiding and rocking the saw circularly in its own plane."

273. For an *Improvement in Printing Ink;* George Matthews, Montreal, Canada East.

Claim.—"The use of the calcined green oxyde of chromium for making ink for printing from engraved plates, from types, or for other kinds of printing."

274. For an *Improvement in Valve Gear for Steam Engines;* Sidney Maltly, Dayton, Ohio.

Claim.—"The means for effecting the reverse cut-off and lead, when said means are arranged directly on the wrist of the engine crank, and used as a substitute for the common link and hook motions."

275. For *Improved Raking Attachments for Harvesters;* John McIntosh, Geneva, Illinois.

Claim.—"The peculiar method of withdrawing and releasing the sliding plate when the same is used in combination with the endless belt."

276. For an *Improvement in Harvesters;* David S. McNamara, North Hoosick, New York.

"The invention relates to a novel means employed for raising the sickle, when it is required to back the machine."

Claim.—"Connecting the shaft by means of the arm and link, with the rod placed at the underside of the draft pole, and connected with the yoke ring."

277. For an *Improved Fence;* James Moore, Pittsburgh, Pennsylvania.

Claim.—"The use of lozenge-formed slats, and the alternate twisting of the wires between the slats."

278. For an *Improved Frame for Combined Mowers and Reapers;* J. A. Moore and A. H. Patch, Louisville, Kentucky.

Claim.—"Making the rear and outer end of the frame of a combined mower and reaper of a single bar of angle iron, when said bar is bent into the form, and united to the frame bars, and to the finger bar and shoe."

279. For an *Improvement in Chilling Plough-shares;* James Oliver and Harvey Little, South Bend, Indiana.

Claim.—"The process consisting in placing the surface of the chill in such a position in relation to the other parts of the mould, that the melted metal shall first come in contact with the chill at the edge of the share."

280. For *Elastic Loop for Suspending Bedstead Slats;* Charles Robinson, Cambridgeport, Massachusetts.

Claim.—"An elastic self-attaching loop for bedstead slats, as a separate article of manufacture not heretofore known."

281. For an *Improvement in Street Lanterns;* John Reese and Charles N. Tyler, Washington, D. C.

Claim.—"The arrangement of the funnel-mouthed aperture, and the valve in the bottom of the lamp."

282. For an *Improvement in Modes of Preserving Green Corn;* David Rowe, Baltimore County, Maryland.

Claim.—"The art and process of preserving green corn in the ear by extracting the pith or heart of the cob, and seasoning and drying the inside of the cob as rapidly as the outside, for preserving the virtues and juice of the grain, and preventing the collection of mold or corruption."

283. For an *Improvement in Fire Arms;* Jacob Shaw, Jr., Hinckley Township, Ohio.

Claim.—"1st, The combination and arrangement of the trigger with the cocking ratch and hammer, whereby the force of the main spring will cause the trigger to continue its motion in a backward direction after it has been forced back to a certain point,

and the introduction of the hair trigger, whereby the trigger may be arrested when it has reached that point, and the hammer by this means be held at the cock point, or by simultaneous action of a force on the hair trigger, in a backward direction, the backward motion of the hair trigger may be allowed, and a consequent disengagement of the hammer be produced to effect a discharge. 2d, The combination and arrangement of the trigger with rotator ratch and locking lever, and the revolving chambered cylinder or block, whereby this block is revolved and locked from the front, instead of the usual mode of the ratchet wheel and pawl in the rear, intending and designing hereby to claim each part and all the parts named in the above claims, in connexion with each other, without intending to limit myself to construct them in the precise form, or of any particular dimensions, but intending to reserve the right to vary them as I may deem expedient, while I attain the same ends by means substantially the same."

284. For an *Improved Mode of Opening and Closing Farm Gates;* Wm. Sherwood, Beloit, Wisconsin.

Claim.—"The use of the crank, in combination with the latch, or its equivalent, and the weight for the purpose of opening and shutting a sliding gate, in which arrangement the gate is opened by one-half revolution of the crank, and shut by the other half revolution of the same; the latch stopping the crank at the end of each half revolution, and the whole being set in motion by a weight, which may be wound up when necessary like the weight of a clock. Also, the arrangement and combination of the lever and the connecting rods with the two parts of the gate, by means of which one part of the gate, when moving in one direction, opens or closes the other part of the gate by a corresponding motion at the same time in the opposite direction."

285. For an *Improved Brake for Wagons;* Hugh Slater, Auburn, New York.

"The invention consists in a peculiar arrangement and combination of devices by the tongue-shaped connexion bar or rod, with its connexion therewith, and with the box arms, by which the forward motion of the wheels may be retarded when required, and the backward motion not impeded."

Claim.—"1st, The peculiar arrangement and combination of devices by means of the tongue or pole, the hinge, the U shaped connexion, the brake rod or bar, and the connexions with the brake arms. 2d, The combination of the pole or tongue, and stop bar, with the sliding bar, or its equivalent, whereby the stop is raised when the carriage is backed, and lowered when it is moved forward."

286. For an *Improved Mortising Machine;* Hezekiah B. Smith, Lowell, Mass.

Claim.—"1st, The adjustable compound treadle, when used in combination with a mortising machine. 2d, The pawl, or its equivalent, in combination with the table, to prevent the action of the chisel from jarring the foot, not intending by this to confine myself to the exact form represented, but adopting any other substantially the same."

287. For an *Improvement in Cartridges;* Gilbert Smith, Buttermilk Falls, N. Y.

Claim.—"Making the cartridge case, or at least the cylindrical portion thereof, of india rubber cloth or vulcanized india rubber, so that though entering loosely into the chamber, by confining it within the chamber, it may be expanded laterally by the force of the explosion of the charge against a joint between the barrel and breech, made near the middle of the chamber to close the same hermetically, and (unlike metal) may after the explosion contract itself by its own elasticity, so as to admit of its being easily withdrawn from the chamber by the fingers of the operator."

288. For an *Improved Raking Apparatus for Harvesters;* Daniel C. Smith, Tecumseh, Michigan.

Claim.—"The mode of operating the rake of a grain harvester, by means of the mechanism."

289. For an *Improvement in Gas Generators;* John W. Smith, Washington, D. C.

"My improvement relates more particularly to the retort and its immediate appurtenances, of a cheap and portable apparatus for the manufacture of gas for illuminating purposes, from oil or other fatty matter, for use in families."

Claim.—"The combination of the retort with the partitions, when the said partitions are furnished with openings arranged in such a manner that the oil or other fatty matter, and the gas produced by its decomposition, shall flow through the retort in currents crossing each other, and alternately dividing and uniting."

290. For an *Improvement in Harvesters;* Charles T. Stetson, Amherst, Mass.

Claim.—"Attaching the finger bar to the frame by means of the guides and the grooved segment guides, the inner end of the bar being provided with friction rollers, which work in said segment guides."

291. For an *Improvement in Manufacture of Journal Boxes for Shafting, &c.;* Daniel Taylor, Carbondale, Pennsylvania.

Claim.—"A journal box or section of a journal box composed of a brass lining and an iron body, when the two are solidly united together by casting the latter upon the former."

292. For an *Improved Die Stock;* James Teachout, Waterford, New York.

Claim.—"Constructing the die holder of the screw cutting die stock in the particular manner, so as to give firm support to the inner portion of the top of the dies as well as to their bottoms and sides, and thereby relieve the scroll and guard plates from all the upward strain or pressure otherwise exerted upon these plates by the inner portion of the dies in cutting screws."

293. For an *Improvement in Coloring Yarn in the Bobbin;* James Thomson and Wm. P. Wakelee, New Hartford, New York.

Claim.—"The use of a vacuum in combination with our arrangement of apparatus, to render the same available in the dyeing of yarn in the cop, bobbin, and the like, without first reeling it into hanks or skeins."

294. For an *Improvement in Resinous Compounds for Covering Hams;* Carter Van Vleck, Macomb, Illinois.

Claim.—"The composition for covering hams or other bodies, consisting of rosin, gutta-percha, and tallow."

295. For an *Improvement in Starch from Maize;* Wm. Watt, Belfast, Ireland.

Claim.—"The manufacture of starch from maize or indian corn, by steeping the whole or uncrushed corn in water heated to a temperature of from seventy to one hundred and forty degrees, Fahrenheit's thermometer, such water being changed several times during the steeping, or applied in continuous or intermittent streams, and then grinding or levigating it with water heated to a temperature of from seventy to one hundred and forty degrees of Fahrenheit's thermometer, and then separating the starch."

296. For an *Improvement for Condensing Liquids in Gas Main Pipes;* John Walton, Louisville, Kentucky.

Claim.—"The employment at any convenient place or places in the gas pipes of one or more vessels or receptacles containing alcohol, or other hygrometric agent."

297. For an *Improvement in Slide Valves for Steam Engines;* Thomas Winans, Baltimore, Maryland.

Claim.—"The connecting of the passages through the ends of the main valve, denominated the Myers' valve, by the channel or openings."

298. For an *Improvement in Defecating Cane Juice;* Leonard Wray, London, England; patented in Belgium June 20, 1854.

Claim.—"A new process, being one whereby excellent crystallized sugar has been and can always be made from the plants; I therefore claim the process."

299. For an *Improvement in Locks;* Ludwig Baier, Assignor to Joseph Lippincott and Wm. C. Barr, Pittsburgh, Pennsylvania.

Claim.—"1st, The sliding tumbler box carrying the tumblers, which by the sliding motion of the box are brought into contact with the bits of the key. 2d, The three armed 'follower,' when arranged, constructed, and operating on, and in combination with, the tumbler box, bolt, and tumblers, with their slots. 3d, The key when constructed so as to form a double bit plate, and operating on the tumblers."

300. For an *Improvement in Ships' Capstans;* Robert Dunbar and John F. Robertson, Assignors to The Buffalo Eagle Iron Works Co., Buffalo, New York.

Claim.—"The arrangement of the cam and eccentric upon the shaft, operated by the lever for throwing in and out of gear the pinions."

301. For an *Improved Automatic Rake for Harvesters;* Joseph S. Manning, Philadelphia, Pennsylvania.

Claim.—"The raking device, consisting of cross-bar, teeth, and swinging bars, and supporting roller, when the same is used in combination with the peculiarly constructed platform."

302. For an *Improvement in Strap Pillow Block for Shafting, &c.;* George H. Reynolds, Medford, Massachusetts, Assignor to self and D. C. Hinckley, Bangor, Maine.

Claim.—"The journal box consisting essentially of the pieces or bushings, and strap."

303. For an *Improvement in Sewing Machines;* Wm. Sage, Durham Centre, Assignor to Henry Sage, Berlin, Connecticut.

Claim.—"1st, Combining the spring stop plate with the needle and loop former. 2d, Giving the point of the loop former an upward motion as the needle rises, and the point of the loop former expands to form the loop. 3d, The construction of the loop former and its arrangement in connexion with the trip and slide, by which it is made to open to spread the loop for the reception of the needle, and close to enter the next loop."

304. For an *Improved Arrangement of Valves in Steam Cylinders;* M. E. Stacy, Assignor to W. John Way, Flemington, Georgia.

Claim.—"The arrangement of valves in steam cylinders."

305. For an *Improved Cross-cut Sawing Apparatus;* Henry F. Wilson, Assignor to self and Henry B. West, Elyria, Ohio.

Claim.—"The radius bars, in combination with the vibrating bars, for the purpose of straining the saw so as to enable me to give the saw a reciprocating motion without guides. Also, placing pins at a greater or less distance apart than pins for the purpose of giving a rocking motion to the saw while reciprocating, said motion to be graduated according to the kind of wood to be sawed."

Additional Improvements.

1. For an *Improved Farm Gate;* Charles N. Cole, Pleasant Valley, New York; patented May 13, 1856; additional dated June 9, 1857.

Claim.—"The arrangement and combination of the levers with the ropes or chains and platforms, they forming a self-acting or balance gate."

2. For an *Improved Cutter for Boring Wheel Hubs;* Leonard S. Maring, Fall River, Massachusetts; patented October 4, 1853; additional dated June 16, 1857.

Claim.—"1st, An additional reamer connexion with the shaft. 2d, A serrated, notched, sickled, or ragged edge of reamers or cutters."

3. For an *Improved Spoke and Axe Helve Machine;* Owen Redmond, Rochester, New York; patented October 30, 1855; additional dated June 23, 1857.

Claim.—"The jointed guides having slots, in combination with the slots having a relative position."

4. For an *Improved Sawing Machine;* Wm. P. Wood, Washington, D. C.; patented February 26, 1856; re-issued March 25, 1856; additional dated June 23, 1857.

Claim.—"The vertical guides and guide rollers, in combination with the swivel link saw bearings."

Re-Issues.

1. For an *Improvement in Grass Harvesters;* Wm. F. Ketchum, Buffalo, New York; patented February 10, 1852; re-issued February 28, 1854; re-re-issued June 2, 1857.

Claim.—"1st, Extending the shoe from the heel of the rack or finger bar upward and forward, and firmly connecting its continuation with the draft, when the finger bar is located so that the power by which the machine is drawn shall, through the shoe, be communicated to and draw forward the heel of the rack or finger bar, thus relieving

the great strain which would otherwise come upon the lateral connexions of the rack or finger bar with the wheel frame, while the heel is enabled to slide over obstructions. 2d, When the main wheel and inner end of the finger bar or rack are located relatively, I claim continuing the shoe from the heel of the rack or finger bar upward and forward until the upper end of its extension reaches a part of the machine which always runs above the mown grass, and which will keep the said grass down, and prevent its rising over the point of the extended shoe, thus aiding the shoe to ride over the mown grass even when accumulated. 3d, Supporting the heel of the rack or finger bar sufficiently near the ground, and at a convenient distance laterally from the main wheel, by arms extending upwards and forwards, and upwards and backwards therefrom, and connected with the frame or spring bars firmly bolted across the frame in front and rear of the said rack or finger bar, while the said frame and bars are elevated to pass over the cut grass. 4th, Supporting the rack or finger bar at the side of, and lower than the main frame, by means of auxiliary framing in a fixed position at the side thereof, and extending downwards and forward, so that while the finger bar is held as near the ground as desired, and lower than the main frame, the main frame may be nearly horizontal in the line of draft, and at any convenient height to avoid clogging or accommodate the diameter of the main wheel; such an auxiliary frame composed of bar, rods, and rack or finger bar, but its details may of course be varied, while the principle is retained. 5th, Supporting the rack or finger bar in its position at the side of, and lower than, the main frame, by extending a strong bar behind said rack or finger bar, firmly supported by said frame, and rigidly connecting said rack or finger bar to said bar by a straight brace or braces, said frame being elevated, and said bar being elevated and placed sufficiently in rear of said rack and finger bar to avoid clogging or lodging of the mown or falling grass against, when said parts are arranged in relation to each other. 6th, Supporting the outer end of the rack or finger bar by a rod extending downwards and forwards from the cross-bar to the finger bar, parallel or nearly so to the face of the main wheel, when the frame and bar are elevated above the rack or finger bar, in the manner and for the purposes contemplated in the last claim, to avoid the falling or clogging of the cut grass against such rod."

2. For an *Improvement in Gas Burners;* Charles H. Johnson, Boston, Massachusetts; patented June 26, 1855; additional dated March 18, 1856; re-issued June 2, 1857.

Claim.—"Combining the gas distributor or the same and the purifier, with the burner so as to operate therewith. Also, elevating the top of the orifice for injecting the gas into the chamber of the burner above the base of said chamber, by a cone, or its equivalent, and so as to form a channel around said orifice for holding tarry matter, as well as for removing it from the orifice. Also, extending the orifice into the distributor, and among its wires, so as to attain advantages."

3. For an *Improvement in Cast Iron Car Wheels;* Anson Atwood, Troy, New York; patented May 15, 1847; re-issued June 9, 1857.

Claim.—"The connecting of the rim of the wheel with the hub in cast iron car wheels, by means of two curved plates starting from near the ends of the hub, and joining at a part of the distance between it and the rim, thus forming a hollow ring or arch around the hub, and joining said ring with the rim by a single plate, or its equivalent, for the uses."

4. For an *Improvement in Ships' Blocks;* Cornelia Waterman, administratrix of Stephen Waterman, deceased, and Isaac D. Russell, City of New York; patented January 31, 1844; re-issued June 9, 1857.

Claim.—"Passing the straps through grooves in the inner faces of the cheeks of the blocks."

5. For an *Improvement in Locomotive Tenders;* Ross and Thomas Winans, Baltimore, Maryland; patented May 23, 1854; ante-dated May 9, 1854; re-issued June 16, 1857.

Claim.—"The tender with an upper and lower platform, in combination with and for the purpose of feeding with greater convenience the furnace of a locomotive steam engine, having upper and lower feeding holes."

6. For an *Improvement in Locomotive Fire Box;* Ross and Thomas Winans, Baltimore, Maryland; patented May 9, 1854; re-issued June 16, 1857.

Claim.—"The downward and rearward inclination of the top or roof, in combination

with the flat grate surface, and the usual feeding hole or door, and with or without the fuel feeding boxes through the roof."

7. For an *Improvement in Means for Guiding Line Ferry Boats or Flying Bridges;* Wm. A. Jordon, Thibodeaux, Louisiana; patented August 5, 1856; re-issued June 16, 1857.

Claim.—"Adjusting the boat relatively with the cable or rope, or by any mechanism, when said mechanism is so arranged as not only to effect the adjusting or turning the boat, but also to retain it when adjusted."

8. For an *Improvement in Flouring Mill;* Joseph Weis, Bordentown, New Jersey; patented January 29, 1856; re-issued June 16, 1857.

Claim.—"The tapering burr, when covered with steel plates, having teeth in disjointed lines, and oblique with the axis of the burr, in combination with the steel pieces, having also oblique teeth, but inclined in a contrary direction to those of the burr, and being dove-tailed into projections cast to the shields, the said projections forming longitudinal grooves running lengthwise on the cone, and crossing the inclined dress."

9. For an *Improved Portable Field Fence;* James G. Hunt, Cincinnati, Ohio; patented December 16, 1856; re-issued June 30, 1857.

Claim.—"Connecting the panels or sections of a fenee by the projections of one or more rails in whole or in part from one section or panel beyond the slats or battens, and between the slats or battens of the adjoining panel, and supporting and locking the fence by compound triangular braces, and arranged with reference to the projection of the rails."

10. For an *Improvement in Looms for Weaving Pile Fabrics;* Mertown C. Bryant, Lowell, Assignor to E. B. Bigelow, Boston, Massachusetts; patented May 19, 1850: re-issued June 30, 1857.

Claim.—"1st, The method of transfering the pile wires in series from the cloth to the shed of the warps. 2d, The method of successivcly cutting the rows of loops or pile on the pile wires."

11. For an *Improvement in Machines for Manufacturing Hat Bodies;* James S. Taylor and Elijah Sturdevant, Danbury, Connecticut, and as administrators of Hiram L. Sturdevant, dec'd., Assignees of Lansing E. Hopkins, City of New York; patented December 7, 1852; re-issued June 30, 1857.

Claim.—"The method of felting hats by passing them or rolling them between the revolving endless planking table, and a series of rollers, or their equivalent, whereby a vibrating, reciprocating, and forward motion is communicated to the hats, thereby working it up in a perfect manner. But this we claim, only when the vibrating and reciprocating motion is communicated to the hats in the direction of the revolving motion of the traveling belt, so as to give the hats a rolling motion alternately forward and back as they pass through the machine."

DESIGNS.

1. For *Cooking Stoves;* Thomas H. Wood, Henry S. Hubbell, and John E. Roberts, Utica, New York; dated June 2, 1857.

2. For *Cook's Stoves;* John D. Marshbank, Lancaster, Pennsylvania; dated June 2, 1857.

3. For *Busts of Napoleon Bonaparte;* Thomas Ball, Boston, Massachusetts; dated June 9, 1857.

Claim.—"The new design for a bust of Napoleon Bonaparte."

4. For *Stoves;* S. W. Gibbs, Albany, New York, dated June 16, 1857.

5. For *Coal Cooking Stoves;* Conrad Harris and Paul W. Loiner, Cincinnati, Ohio; dated June 23, 1857.

6. For *Wood Parlor Stoves;* Conrad Harris and Paul W. Loiner, Cincinnati, Ohio; dated June 23, 1857.

7. For *Dining Room Stoves;* Conrad Harris and Paul W. Loiner, Cincinnati, Ohio; dated June 23, 1857.

8. For *Cooking Stoves;* S. W. Gibbs, Albany, New York, Assignor to North, Chase & North, Philadelphia, Pennsylvania; dated June 23, 1857.

9. For *Stoves;* N. S. Vedder, Troy, New York, Assignor to North, Chase & North, Philadelphia, Pennsylvania; dated June 23, 1857.

10. For *Stoves;* Jacob Beesley and E. J. Delancy, Assignors to Cresson, Stuart & Peterson, Philadelphia, Pennsylvania; dated June 23, 1857.

The claims on the above, with the exception of No. 3, are for the several shapes, forms, and ornaments.

JULY 7.

1. For an *Improvement in Machines for Husking Corn;* George W. Bachman, Clifton Springs, New York.

Claim.—"The grooved cylinder wires and knife, in combination with the reciprocating screen, provided with clearing teeth, and reciprocating toothed board, the whole being arranged to operate conjointly."

2. For an *Improved Metal Separator;* Edward Borlase, Bristol, Connecticut.

Claim.—"The use of the conical reservoirs, when arranged in connexion with the sieves."

3. For an *Improvement in Truss Bridges;* Josiah Brown, Jr., Buffalo, New York.

Claim.—"Providing each of the main and counter braces with two gains at top and bottom, and each of the timbers of the chord with a gain at a point where the braces are applied corresponding with the gains in the braces, and passing the braces thus formed up between the timbers with the gains of the braces in such relation to the gains of the timbers, that when the timbers of the chords are brought together they are combined, and become as it were only one piece, no part of which can be operated upon or affected independently of the other, by the downward and upward thrusts common to truss bridges, even if the bolt which passes laterally through and intersects each set of braces and the timbers of the chord were removed."

4. For an *Improved Machine for Cutting Paste-board, &c.;* Denzlow Burhaus, Burlington, Iowa.

Claim.—"The employment in connexion with the grooved feed rollers, of a double-edged or V shaped cutter. Also, the combination of the steadying roller with the feed roller."

5. For an *Improvement in Steering Apparatus;* Dexter H Chamberlain, West Roxbury, Massachusetts.

Claim.—"The nuts with their vibrating feathers, in combination with the parallel shafts, when the said nuts rest against, and are guided by, the middle shaft."

6. For an *Improvement in Instruments for Cutting Button Holes;* William Chicken, Boston, Massachusetts.

Claim.—"My improved button hole cutter."

7. For an *Improved Air Chamber to Effect Uniformity of Flow of Water, etc., through Pipes;* Thomas Clark, Philadelphia, Pennsylvania.

Claim.—"The arranging of an elastic or extensible sack or bag in the line of a pipe or water way, when said sack is surrounded with a casing and air chamber."

8. For an *Improved Alcohol Blow Pipe;* Edward Conway, Dayton, Ohio.

Claim.—"The use of the compound regulator of the safety valve, in combination with the tubes and the three-way cock of the boiler."

9. For an *Improvement in Grain Separators;* Amasa Curtis, Lena, Illinois.

Claim.—"The auxiliary shoe provided with the adjustable slats, in combination with the valves in the fan box."

10. For an *Improvement in Corn Harvesters;* Israel Dodenhoff, Bloomington, Illinois.

Claim.—"1st, The arrangement of the knives in relation to each other, when combined with the peculiar shape of the teeth. 2d, The armed belt and spring guide bars, for holding, guiding, and carrying the corn, so as to deposit it in the arms of the col-

lector, in the rear of the machine, in combination with the cutting apparatus, the whole being arranged in relation to each other."

11. For an *Improved Box Window Frame;* Joseph B. Dodge, St. Louis, Missouri.

Claim.—" The employment of the beads commonly used in window frames to hold the sash to their place, to form the box for the weights, using grooves for that purpose on the inside of the jamb, and on the underside of the beads, placed together, forms the box for the weights."

12. For an *Improvement in Machines for Husking Corn;* William Emery, Jr., Chester, Illinois.

Claim.—" The combination of the rotating hub and knife, inclined box or trough, and stripping hooks, when the above parts are arranged to operate."

13. For an *Improvement in Dry Sand Cores;* Wm. Gage and Richard B. Felthousen, Buffalo, New York.

Claim.—" The application and use of glue or blood (either separately or in combination), mixed with sand, for the purpose of making dry sand cores for founding purposes."

14. For an *Improvement in Self-priming Gun Locks;* Mahlon I. Gallager, Savannah, Georgia.

Claim.—"The shipper which relieves the sliding rod, and allows the fire arm to which the improvement is attached, to be used with the ordinary percussion cap, without exhausting the primers from the cylinder, or for the convenience of sportsmen, and without which a self-capping hammer is valueless to sportsmen."

15. For an *Improved Machine for Tapping Nuts;* Almon B. Glover, Birmingham, Connecticut.

Claim.—" 1st, Giving the arbor simultaneous with its reciprocating rotary motion, a longitudinal movement back and forth by means of the collar placed on the shaft, and provided with the spiral grooves and inclined or oblique end, and the bar which is placed loosely on the shaft, and connected with said collar. 2d, The employment or use of the spring placed within the sleeve, and the spring placed on the shaft and connected with the arms, for the purpose of allowing the arbor and arms an independent movement, and thereby preventing any injury which might otherwise be produced by any irregularity in the feeding of the blanks within the tap box."

16. For an *Improved Device for Securing the Stock to the Guide Rods of Joiners' Ploughs;* Stephen Going, City of New York.

Claim.—" Securing the stock on the guide rods by means of the bar, fitted within the stock, and actuated by the screw."

17. For an *Improved Machine for Straightening Veneers;* Joseph H. Goodell, Bridgeport, Connecticut.

Claim.—" The reduction or removal of the curve or scroll shape given the veneer in its cut from the log or stick, by the introduction and feed of it endwise, that is, transversely to the general direction of the curve assumed by it in the cut between a roller or rollers, and carrying and pressing apron, arranged for operation together and on the veneer. Also, in combination with the several rollers and endless carrying and pressing apron, when the same are relatively arranged, the adjustable frame to the one roller, to give increased or diminished pressure to the apron against the back of the pressing roller, or interposed veneer."

18. For an *Improved Wrench;* John H. Hathaway, Millbury, Massachusetts.

Claim.—"Making the ratchet or part corresponding thereto of separate pieces between which the catch enters. Also, the aforesaid ratchet or series of slips, in combination with the stationary and sliding jaws, or their equivalents."

19. For an *Improvement in Upsetting Tire;* Rockwell Hazen and Volney Gibbs, Homer, Michigan.

Claim.—" The sliding blocks with knives attached, and the heads fitted in slots in the plates to which the blocks are attached, the inner blocks having knives attached, which knives are actuated by the wedges, the above part being used in connexion with the plates; it being understood that we do not claim separately either of the parts, but the whole when arranged to operate conjointly."

20. For an *Improved Cutting Apparatus for Harvesters;* Joseph Irwin, Frankfort, Ohio.

Claim.—"The spiral cutter, when the same is arranged below, and used in combination with, the curved cutting fingers."

21. For an *Improvement in Locks;* Henry Isham, New Britain, Connecticut.

Claim.—"Combining with the mechanism for throwing the bolt, or any equivalent therefor, a mechanism which rotates with the said bolt throwing mechanism, and which by such rotation at the end of the throw of the bolt interposes its periphery to the line of travel of the bolt, or some part of it, and thereby prevents the bolt from being forced back, until the bolt throwing mechanism is brought to the required position for throwing back the bolt. Also, the combination of the non-cogged sectors, and the cogged sectors on the key-bit, with the cogs and projections on the tumbler slides, or any equivalent therefor, whereby the said slides are controlled by the key-bit. Also, the mode of imparting intermittent motion to the key-bit, and stopping the same, while the mechanism which imparts such motion continues to move by means of the wheel and pinion, having their engaging peripheries constructed as described."

22. For an *Improved Method of Backing Electrotype Plates;* Albert H. Jocelyn, City of New York.

Claim.—"Backing shells for printing embossing and like purposes, by pressing type or other suitable metal down upon the shell while in a fluid or elastic state."

23. For an *Improved Method of Connecting the Panels of Field Fences;* Samuel F. Jones, Milford, Indiana.

Claim.—"The method of connecting the panels of a field fence, by tongues and grooves, and hook combined."

24. For an *Improvement in Belt Shifter for Machinery;* Lucius J. Knowles, Warren, Massachusetts.

Claim.—"1st, Shifting a belt or band from one pulley to another by means of two rollers capable of vibration, so as to be set slightly oblique, either to the right or left, to a line at right angles with the edge of the belt or band. 2d, The peculiar construction of the upper roller. 3d, Having the roller capable of sliding on its axle, as it shifts the belt."

25. For an *Improvement in Sewing Machines;* E. T. Lathbury, Buffalo, New York.

Claim.—"The looper composed of two elastic pointed fingers, and operating in combination with the needle, so that the needle passes through the looper while the loop is extended upon it, then escapes from it by opening its point as the looper is withdrawn from the loop."

26. For an *Improved Cutting Apparatus for Harvesters;* John P. Manny, Rockford, Illinois.

Claim.—"Causing a series of cutters to cut from right to left, and from left to right, between each pair or set of fingers, at every single revolution of said series of cutters upon their shaft or journals. Also, in combination with such series of cutters, the recesses in the sides of the fingers, into which they may enter to enable them to clear themselves from the clogging matter that gathers and accumulates (unless somehow prevented) in all harvesting machines."

27. For an *Improvement in Paper Cop Tubes;* Alexander McCausland, Providence, Rhode Island.

Claim.—"The paper cop tube made of a strip of paper of the form represented in the diagram, whereby greater strength is given to the base of the tube, while the desired conical form is at the same time attained."

28. For *Improvements in Railroad Car Stove;* James Spear, Philadelphia, Pa.

"My improvements relate to hot air stoves for warming the interior of railroad cars, where the supply of air is driven into the stove by the force of the wind, or of the current created by the rapidity of the motion of the cars."

Claim.—"The combination of the cross tube and its self-acting valves with the air tube, so constructed and arranged as to conduct the external air to the heater when the cars are in rapid motion, either forward or backward, and to prevent the escape of the heated air when there is no descending current."

29. For an *Improved Gold Washer and Amalgamator;* T. V. Tavnay, San Francisco, California.

Claim.—"The metal plates coated with mercury, the riffles, vanes, and reacting surfaces."

30. For an *Improved Sash Lock;* Marcus P. Norton, Troy, New York.

Claim.—"Making a double window sash lock and fastener, with an upper and lower branch, which converge and unite into one at or near the knobs or upper end."

31. For an *Improvement in Cooking Stoves;* William Resor, Cincinnati, Ohio.

Claim.—"The combination with a customary reverting flue cooking stove of the funnel shaped descending flues, enclosing a reverberatory chamber, communicating with the central or reverting flue on one side of a supplemental oven, and with the escape flue on the other side."

32. For an *Improved Scroll Wheel for Harvesters;* Charles D. Rogers, Utica, New York.

Claim.—"Constructing scroll wheels of harvesters in two separate parts, when both the adjustable portions and main rim are constructed and arranged in the peculiar manner."

33. For an *Improved Air Heating Stove;* Charles B. Sawyer, Fitchburgh, Mass.

"This invention relates solely to an improvement in an air heating device, formerly patented by John Sawyer, in which a ventilating chamber, hot air flue, smoke flue, and air heating chamber are arranged and combined in a peculiar way for effecting the desired purpose."

Claim.—"The pipes for the admission of cold air direct into rooms when said pipes are made to pass through the ventilating chamber, for the purpose of creating the necessary draft, and used in connexion with the hot air pipes and ventilating pipes. Also, the chamber placed over the hot air flue and ventilating chamber, when arranged relatively with the flue chamber and pipes."

34. For an *Improved Shaft Coupling;* Edwin F. Shoenberger, Germantown, Pa.

Claim.—"The combination and arrangement of the levers with their half roller box, clip, and slot, for the purpose of being applied to shaft couplings for safety, and to prevent rattling."

35. For *Improved Whiffle-trees;* David A. Smith, Washington, D. C.

"This invention consists in an improved mode of attaching and detaching traces from whiffle-trees."

Claim.—"The lever attached to a fulcrum on plate, and sliding in slotted plate, for operating the spring bars alternately."

36. For an *Embossing and Printing Press;* Samuel Joseph Smith and Charles Lockle, City of New York.

Claim.—"The arrangement of the inking table, die, springs, roller, and its lever. Also, the raised metallic counter die for embossing, when covered with a thin coating of gutta percha, to enable said metallic counter die to give a perfect impression of ink from the embossing die on those parts of the paper that are not raised by the embossing die, simultaneously with said embossing."

37. For an *Improvement in Covering for Drawing Rolls;* Joseph M. Smith, Manchester, New Hampshire.

Claim.—"The use of black lead in combination with india rubber as a material for covering drawing or draft rollers, for the purpose of avoiding the effects of electricity, and the adhesion of the cotton to the rollers."

38. For an *Improved Melodeon Attachment;* D. L. Sprague, Townsend and Riley Burditt, Brattleboro', Vermont.

Claim.—"1st, The hammers of the 'harp attachment,' arranged between the keys and reeds of the melodeon, and combined with the inverted jacks attached to the bottom of the keys, whereby the ordinary keys of the melodeon are made to serve without any extension to play the harp attachment. 2d, The attachment of the string dampers of the 'harp attachment' to the melodeon keys. 3d, The employment of a bar extend-

ing below the whole of the hammers, and operating to move all the hammers simultaneously to such a position that the jacks are inoperative upon them."

39. For an *Improvement in Brick Machine;* Stephen Ustick, Philadelphia, Penna.

"This invention consists in the peculiar construction and combination of parts for pressing and discharging brick."

Claim.—"The piston and filling box when connected together, in combination with the movable and weighted mould box, and lower piston, when said parts are constructed and arranged to operate in relation to each other."

40. For an *Improved File Cutting Machine;* William Van Anden, Poughkeepsie, New York.

Claim.—"The arrangement of a bed on which the file blank is cut, having a forward positive feed motion, and an independent forward motion against the edge of the chisel, in consequence of the percussion of the hammer, and the difference of the resistance of the metal at the back edge of the chisel, wedging it forward at the time of cutting the teeth of the file to cause their upsetting. Also, the combination and arrangement of the bed on which the file blank is cut, with the triangular feed gate and side rails of the machine frame. Also, the combination and arrangement of the ratchet wheel spring, and detent pins, or their equivalents, in combination with the pawls for operating the same. Also, the use of the compound self-adjusting chisel holder stock, in combination with the chisel, whereby it is held rigidly in its place under the blow of the hammer. Also, the use of the triangular gate as a feed motion to my compound bed, in combination with the apparatus for operating the same."

41. For an *Improvement in Metallic Pens;* F. A. Wait, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the spring guard and slots in a pen."

42. For an *Improved Mode of Operating Radial Cutters in Lathes for Beaded Work;* George W. Walton and Henry Edgarton, Wilmington, Delaware.

"This invention consists in a cutting device peculiarly arranged and operated, for cutting the beaded or similar ornaments on the sticks."

Claim.—"The rotary pattern, bent lever, arms, connected to the sliding collar, in combination with the swinging or oscillating cutter stocks."

43. For an *Improvement in Method of Applying Railroad Car Brakes;* Ira J. Webber, Salem, Massachusetts.

"This invention consists in an apparatus for the purpose of operating the brakes of railroad cars, whereby the brakeman is enabled to apply the brakes of all the cars of the train by putting on the brakes of the hindmost car."

Claim.—"The apparatus for the purpose of applying railroad car brakes, consisting essentially of the sliding bolt and the dogs, or their equivalents."

44. For an *Improvement in Lifting Jack;* Heber G. Seekins and Charles H. Goss, Elyria, Ohio.

Claim.—"The concave and convex surfaces of the wedge, in combination with the concave surface of the upright, for the purpose of equalizing the direction of the pressure."

45. For an *Improvement in Machines for Trimming Hedges;* William Wimmer, Billingsville, Indiana.

Claim.—"The duplex arrangement of shears, both sets being actuated from the same driving-wheel, being adapted to trim simultaneously the top and one side of the hedge to any desired uniformity, height, and pitch."

46. For an *Improvement in Rock Drilling Machine;* Lemuel P. Jenks, Assignor to George A. Gardiner, Boston, Massachusetts; ante-dated January 7, 1857.

Claim.—"The use and application of the india rubber, when interposed in such manner that its expansive force shall operate the drill in rock drilling machines."

47. For an *Improvement in Rock Drilling Machines;* George A. Gardner, City of New York, Assignor to self and Lemuel P. Jenks, Boston, Mass.

Claim.—"The peculiar combination and arrangment of the devices, whereby the rotation of the mandrel and drill, as well as the gradual and proper advancement of both drill, mandrel, and frame, or either of them, is effected by means of a single eccentric on the cam shaft."

48. For an *Improved Gas Stove;* Patrick Mihan, Assignor to Robert .B Fitts, Boston, Masssachusetts.

Claim.—"The combination and arrangement of the deflector with the conical or tapering cap, the gas receiving case, and the air passage. Also, the combination and arrangement of the perforated open tube or conductor and the secondary top with the oven, and so as to operate therewith, and not only improve its baking powers, but render it capable of applying heat to a kettle, or other article placed in or on said part or tube."

49. For an *Improvement in Pumps;* Henry Pease, Assignor to Eckler, Buswell & Co., Brockport, New York.

Claim.—"The guide rods constructed and arranged for the purpose of preventing the rotation of the piston, and of facilitating the attachment and detachment of the shaft to and from the crank."

50. For an *Improved Bit Brace;* Henry W. Porter, Rothsville, Assignor to Samuel G. Porter, West Earl, Pennsylvania.

Claim.—"Combining the knob with the bit holder by means of the auxiliary handle, whenever it may be necessary to bore holes in situations where it is impossible to rotate the bit brace. And in connexion therewith, I also claim the double ratchet wheels on the spindle, when arranged in such a manner in relation to the detent as to enable the necessary connexions and disconnexions to be effected between the bit holder and the permanent and auxiliary handles of the brace."

51. For an *Improved Bit or Drill Holder;* Amos J. Smith, Assignor to self and Geo. W. Otis, Lynn, Massachusetts.

Claim.—"The combination of the sliding key or bar and thimble, with the spring, and stationary catch or projection."

52. For an *Improvement in Gas Stoves;* Thomas Walters, Boston, Mass., Assignor to Stephen Sherlock, Eastport, Maine.

Claim.—"The combination of the main chamber of combustion, made to communicate by one or more passages with the main chamber, and having pipes extending through the chamber, and arranged so that air in passing through the said pipes may be heated by the heated products in the chamber. Also, the air and gas burner and supply pipe, in combination with the main and auxiliary chambers of combustion made to communicate with each other. Also, the combination of the reverberating bell or dome with its auxiliary chamber and the main chamber, when furnished with burners, and connected with one another and the external atmosphere."

53. For an *Improvement in Hay Rakes;* S. W. Wood, Washington, D. C., Assignor to Lewis H. Parsons, City of New York.

Claim.—"A hay rake consisting of a loose revolving tube, in combination with a segment wheel placed upon an axle, said tube being provided with the teeth of any desired form or material."

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54. For an *Improved Machine for Making Railrod Chairs;* Robert Archer, Richmond, Virginia.

Claim.—"The use of the swages operating in connexion with the adjusting levers, whereby uniformity in the length of the lips is secured, without reference to the length of the plate."

55. For an *Improved Machine for Gauging and Filing Saws;* Emanuel Andrews, Elmira, New York.

Claim.—"The adjustable gauge and guide rollers, arranged and operating, by means of which the cutting angle or rake of the teeth shall be accurately gauged before filing, the rollers acting as stops to prevent the further cutting of the file when the proper point is attained. Also, the adjustable setting gauge, consisting of the movable jaws combined with the files or other cutting surfaces which shall be equivalent in their operation, for the purpose of gauging the width of set which the saw is to receive, and also for dressing and finishing the points of the teeth smoothly and uniformly after being set."

56. For an *Improvement in Fastening Artificial Teeth to the Metallic Plate;* Theodore H. and James P. Bradish, Utica, New York.

Claim.—"The construction and attachment of the linings in the manufacture of artificial teeth, by raising upon the back of the linings by which one or more series of separate anchors or projections are constructed, and when so formed and imbedded into the plastic material of the tooth at the time of the moulding, shall constitute the solid tooth and lining."

57. For an *Improved Pen and Pencil Case;* Edward Baptis, Hudson, N. J.

Claim.—"The employment or use of such grooves when made with a varying pitch."

58. For an *Improvement in Cultivator Ploughs;* George G. Black, Crossinville, Ohio.

Claim.—"The rod, arranged between the beams, and provided with a cross-bar, upon which the beams can vibrate when the ploughs are adjusted."

59. For an *Improved Nail Plate Holder;* William H. Battelle, New Castle, Penna.

Claim.—"A nail plate holder, composed of the socket, socket head, and guide, and the jaws held thereto by a ring."

60. For an *Improvement in Harvesters;* John P. Manny, Rockford, Illinois.

Claim.—"The combination of two frames, one of which is adjustable and can be raised or lowered at pleasure, with the lifting piece and platform hinged to said adjustable frame, when said parts are constructed and arranged to operate in relation to each other."

61. For an *Improvement in Rigging Ships;* James E. Cole, Brooklyn, New York.

Claim.—"Placing the centres of motion of the yards of a square-rigged vessel in line with each other."

62. For an *Improvement in Churns;* Charles H. Dana, West Lebanon, N. H.

Claim.—"The irregular curved pieces forming the undulating slot, in combination with the slotted oscillating frame and cross-bar, with friction rollers, for giving three up and down strokes to the dasher at each oscillation of the cream vessel."

63. For an *Improved Automatic Lathe;* Alexander Edmonds, Mount Pulaski, Ill.

Claim.—"The combination of the rotating cutter, provided with a gauge regulating the diameter of the rounds or cylinders with the nippers, for forming chair stuff. Also, the arrangement in the tenoning machine of the regulating screw and cap, with the chamfer chisel."

64. For an *Improved Device for Sealing Bottles, Cans, &c.;* Mills B. Espy, Philadelphia, Pennsylvania.

Claim.—"The combination of the upper plate having the slot and the two hooked projections, the lower plate having the screw hole and the two hooked projections, with the thumb-screw and jam nut, the same being adapted and arranged together so as to be applicable to the mouth of a bottle or jar."

65. For an *Improvement in Washing Machines;* Adam Fisher, Leavenworth City, Kansas Territory.

Claim.—"The combination of the bucketed wheel, constructed with the plain surfaced rubbing wheel."

66. For an *Improvement in Mattresses;* William P. Ford, Cheneyville, La.

Claim.—"A mattress of moss."

67. For an *Improvement in Corn Planters;* Alvin Franklin, Genoa Cross Roads, Ohio.

Claim.—"The combination of the plough-box extension and hoe in the rear of the planting tube or passage for operation together, and with an intermittent corn discharge or seed depositing arrangement. Also, providing the plough-box extension with a knife or scraper, arranged in relation to the hoe, for the purpose of clearing the latter in its back spring or stock."

68. For an *Improvement in Rope Machines;* Ezekiel Guile, St. Louis, Missouri.

Claim.—"The additional laying flyer. Also, the automatic stopping apparatus. Also, he curvilinear dies."

69. For an *Improvement in Setting out the Packing of Pistons for Steam Engines;* George H. Hoagland, Port Jervis, New York.

Claim.—"The setting out the packing by means of a tapering mandrel placed in the centre of the piston rod."

70. For an *Improvement in Piano Fortes;* G. Henry Hulskamp, Troy, New York.

Claim.—"1st, The arrangement and construction of the action of piano fortes, having the jack, under hammer, and springs attached to the key and moving in the same general direction with the hammer butt. 2d, The use and application of the spring, extending through the head of the under hammer to bear against the hammer butt. 3d, The regulating screw in the head of the jack, or its equivalent, in the head of the under hammer, to regulate the height of that part of the action. 4th, The shape of the hammer butt with its spiral spring. 5th, The dolce harmonic attachment, or its equivalent, and its parts, to wit, the interposing of a substance to touch one string only of a note, and the making of such substance to vary in hardness with the different notes of the instrument. 6th, The corrugated string."

71. For an *Improvement in Churns;* Silas Hewit, Seneca Falls, New York.

Claim.—"The floats, in combination with the flanches."

72. For an *Improvement in the Use of Coal Tar in Iron Furnaces;* Isaac G. Johnson, Spuyten Duyvel, New York.

Claim.—"The employment of coal tar in the air furnace."

73. For an *Improved Shot Cartridge;* William B. Johns, of the U. S. A.

Claim.—"The combination of the counter sunk base piece, copper disk, case, and felt disk."

74. For an *Improvement in Applying Fly-wheel to Hand Cars;* Charles T. Kipp and John Lawrenson, City of New York.

Claim.—"The arrangement of levers and rods attached to crank wheel for operating the fly-wheel."

75. For an *Improvement in Hemp Drawing Machines;* Samuel Lownds, Brooklyn, New York.

Claim.—"The arrangement of a hemp drawing frame, having its gills operated by guide dogs upon both sides of the frame, and attached to each alternate row of gills."

76. For an *Improved Seal for Car Doors, &c.;* D. W. Long, Baltimore, Maryland.

Claim.—"Effectually securing the seals of car or other doors from accidental or designed injury."

77. For an *Improvement in Cultivators;* Howard Mann, San Francisco, California.

Claim.—"The arrangement of shanks with rack-bars and segmental plates."

78. For an *Improved Raking Apparatus for Harvesters;* John P. Manny, Rockford, Illinois.

Claim.—"In combination with a contracting trough-shaped platform, a self-contracting and elongating rake. Also, raising and lowering a rake to cause it to preserve its relative working position with regard to the platform, as said platform is raised or lowered."

79. For an *Improved Device for Feeding the Cutter Intermittently in Mortise-boring Machines;* Hiram E. Paine, Troy, New York.

Claim.—"Constructing the machine so that the revolving sidewise reciprocating mortising bit thereof is moved by the machine alone, endwise into the timber, at, and only at, the ends of the mortise, whatever length of mortise is being cut. Also, the means used to prevent increased trembling of the mortising or boring bit as the depth of the cutting increases."

80. For an *Improved Spiral Catch for Breast Pins;* John F. Mascher, Philadelphia, Pennsylvania.

Claim.—"Constructing breast pins, brooches, and other ornamental fastenings for dress, &c., with a spiral catch."

81. For a *Seal for Railroad Freight Cars, &c.;* Henry D. Mears and Wm. Houlton, Jr., Baltimore, Maryland.

Claim.—"The device for sealing, the same consisting of soft metallic disks connected by a strip or wire of hard metal."

82. For a *Seal for Railroad Freight Cars, &c.;* Henry D. Mears and Wm. Houlton, Jr., Baltimore, Maryland.

Claim.—"The seal, the same consisting of a disk of soft metal, having one or more holes or slots through it for the reception of the ends of a wire or metallic strip, which are confined by the compression of the disk."

83. For an *Improved Self-setting Trap Hook;* Donald McLean, Boston, Mass.

Claim.—"The combination of the hooks with the elastic cord or spiral spring and line."

84. For an *Improvement in Locks;* L. F. Munger, Le Roy, New York.

Claim.—"The combination of the wheels with the arbor, said wheels being retained in position, and imparting motion to each other."

85. For an *Improved Mode of Constructing Carriages;* Rufus Nutting, Randolph, Vermont.

Claim.—"The arrangement of compensating springs with the front and rear axles, so that while the axles are retained in their proper positions, the action of the compensating spring prevents the spreading of the axles on one side of the vehicle, and thereby tends to preserve the accurate tracking of the hind wheels. Also, the combination of the guard with the hinder part of the springs."

86. For an *Improvement in Cotton Gins;* Daniel Pratt, Prattville, Alabama.

Claim.—"The ledge secured or placed within the hopper or box, so as to close the central portion of the lower end of the hopper or box, and cause the cotton when fed into the box to be fed spirally to the saws from the centre of the box towards each end."

87. For an *Improvement in Lime Kilns;* Leonard Phleger, Philadelphia, Penna.

Claim.—"The employment in a lime kiln of a series of water cells for supporting the limestone."

88. For an *Improvement in Locking Cylindrical Door Bolts;* Charles G. Page, Washington, D. C.

Claim.—"Locking the bolt by means of the loose handles."

89. For an *Improved Draining Machine;* A. P. Routt, Somerset, Virginia.

Claim.—"The employment in connexion with a double mould board plough, of a heavy V shaped or taper roller, said roller being hung so as to run behind and between the two mould boards, and so as to be capable of revolving and adjusting itself to the different depths at which the plough may be set to cut."

90. For an *Improvement in Oil Cans;* George W. and George H. Simmons, Bennington, Vermont.

Claim.—"Fastening the air vessel or tube to the oil tube, and the oil tube to the stopper, so that the whole may be removed together for the purpose of cleansing or repairs, by which means we produce a better article of manufacture than when said tubes are fastened to the can and are not removable."

91. For an *Improved Fly-Trap;* William T. Shannon, Greensboro', Georgia.

Claim.—"The invention of the box and the bag, and its attachment to the box, for the purposes heretofore mentioned."

92. For an *Improvement in Wrest Pins for Pianos;* Gustav Schilling, Hoboken, New Jersey.

"This invention consists in attaching the string to the end of an adjustable screw in such a manner that by raising or lowering the screw, the straining or unstraining of the string is effected exactly in the same vertical direction with the axis of the screw, by which arrangement all lateral pressure on the screw is avoided, and all injury to the several parts of the wrest pin as well as to the string is rendered impossible."

Claim.—"Combining the heads of wrest pins with an adjustable screw, to which

the string is attached, in such manner that the direction of the straining force is mathematically true in the direction of the axis of the adjustable screw."

93. For an *Improved Machine for Cutting Metal;* James Tetlow, Salem, Mass.

Claim.—"The forming of the cutter with an obtuse angle, in such a manner as to give to the surface of the plate, while being cut, a broad, flat bearing to rest upon while the other cutter is cutting through the plate; the obtuse angle of the cutter being the supplement of the acute angle of the plate when cut."

94. For an *Improved Centring Machine;* Edward F. Whiton, West Stafford, Conn.

Claim.—"Arranging the laterally adjustable notched holders in such a manner in relation to the longitudinally adjustable spindle, and its pointed marker, as to enable the ends of shafts of various sizes to be centrally marked."

95. For an *Improvement in Locks;* William Whiting, Roxbury, and Henry Pickford, Boston, Massachusetts.

Claim.—"The combination of the slides with the pawl, so arranged that whenever the slides are allowed to touch the tumblers, the pawl shall engage the teeth of the tumblers, and hold them stationary. Also, operating the slides, the bolt, and the pawl, directly from the wrench shaft."

96. For an *Improved Method of Adjusting Round Tenon Cutters to certain Fixed Sizes;* Melyn Weatherington, Springfield, Ohio.

Claim.—"The combined use of the uncut counter sunk disk and removable rings, and the bit adjustable thereto, for the purpose of making an adjustable hollow auger capable of boring tenons of various sizes without splitting or dividing the stock."

97. For an *Improvement in Governors of Steam Engines, &c.;* A. F. Ward, Louisville, Kentucky.

"This invention consists in the arrangement and employment of a double armed screw socket, clutch, and friction socket."

Claim.—"The arrangement of the friction socket, the female screw socket, with its arms, and the clutch on the governor rod; the whole combining to operate so that the female screw socket may be prevented turning till the full supply of steam is given, or till the steam is cut off entirely, and afterwards be caused to turn with the governor rod."

98. For an *Improvement in Bureau Bedsteads;* Ethan Whitney, Boston, Mass.

Claim.—"My improved manufacture of bureau bedstead, viz: with the bedstead portion made in two parts hinged together, and applied to the case by projections and grooves, in order that the said bedstead may be either folded together and slid back into the case, or be drawn forwards and out of the case, and unfolded or let down into a horizontal position, as circumstances may require."

99. For an *Improvement in Machines for Cleaning Cotton;* Lewis S. Chichester, Assignor to Henry G. Evans, City of New York.

Claim.—"The combination of the spring bars, one or more series, the hopper, rotating picker or arms, shake screens, and deflecting screens."

100. For an *Improvement in Pumps;* Birdsill Holly, Assignor to Silsby, Mynderse, & Shoemaker, Seneca Falls, New York.

"This invention relates to certain improvements in lifting pumps, and consists in the peculiar means employed for allowing, when necessary, the waste or surplus water to escape from the cylinder."

Claim.—"The leather placed over the perforations in the top of the vase, and the chamber which is placed on the leather, said leather being provided with a flanch provided with holes, either of which is fitted on the pin for the purpose of exposing or closing the passage."

101. For an *Improvement in Cultivators;* Henry Schreiner, Jr., Assignor to self and George Lark, Berrysburg, Pennsylvania.

Claim.—"In connexion with the cultivator, the arrangement of the cross beams and the transverse beam."

102. For an *Improved Lubricator;* Henry J. Hawkins, Mobile, Alabama.

Claim.—"The general arrangement of this lubricator with its mode and manner of admitting the lubricating substances, so as to strike at once on all parts of the interior surface of the cylinder."

103. For an *Improved Mode of Cutting Tenons by two Circular Saws oblique to Shaft;* Wm. H. Harrison, Philadelphia, Pennsylvania.

Claim.—"The use of two circular saws upon the same shaft, when their planes form an acute angle with each other, and made adjustable on their shaft."

104. For an *Improvement in Railroad Car Seats;* Bernard J. La Mothe, City of New York.

Claim.—"Constructing seats with elliptical springs at the sides, receiving the cushions on the upper part of said springs, when combined with the friction rollers, or their equivalents, whereby a lateral motion is allowed to said seat. Also, constructing the back of the seat by an enclosing frame formed of the double bent rod, with eyes at both ends, through which eyes, and between the bends of which rod, the sustaining pipe or rod passes."

JULY 21.

105. For an *Improvement in Inking Rollers for Printing Presses;* E. E. Barrett, Chicago, Illinois.

"My improvement consists in the use of a hollow inking roller, perforated with a number of holes, through which the ink oozes, saturating the material with which it is cased for the purpose of inking the type, thus constituting a fountain or self-feeding inking roller."

Claim.—"Saturating or coating the inking roller of a printing press with ink."

106. For an *Improvement in Feed Motion for Sewing Machines;* Abraham Barthelf, City of New York.

"This invention relates to the rotary or wheel feed, and consists in certain novel, simple, and effective means of producing and controlling the movement of the feeding wheel."

Claim.—"1st, Giving the necessary motion to the feeding wheel through the agency of a collar, or its equivalent, which by being turned in one direction around a central shaft fitted loosely in said wheel, is caused to move longitudinally on the said shaft towards the wheel, and thus clamp the wheel in one direction parallel with the length of the shaft against a flanch, or its equivalent, fast on the shaft, and thus to carry with it both the shaft and wheel in a circular direction, but which on being turned in the reverse direction is caused to move in the reverse direction parallel with the shaft, and thus to liberate the shaft from the feed wheel, and allow it to return without the said wheel. 2d, The attachment rigidly to the loose feed wheel shaft of a lever, or its equivalent, so operated by a cam, or its equivalent, that when the loose clamping collar, or its equivalent, is allowed to return after having given motion to the shaft and feed wheel together, the shaft is temporarily prevented returning with the clamping collar, or equivalent, and thus the friction between the wheel and the fast flanch or projection against which the wheel has been clamped by the clamping collar, is made to aid in preventing the return of the wheel with the loose clamping collar, or its equivalent."

107. For an *Improved Arrangement of Camels for Raising Sunken Vessels;* Thomas Bell, City of New York; patented in England, April 16, 1856.

Claim.—"The arrangement of camels whereby great strength is secured to support a vessel while being raised and transported, and whereby the vessel will be lifted principally by the bow and stern, or where the greatest strength exists, and only partially fore and aft or where the least strength exists; and whereby all the inconveniences attending the application and use of those devices which require that some of their parts shall be passed under the keel, or over or through the vessel, are avoided, and the numerous benefits secured."

108. For an *Improvement in Machines for Planting Potatoes;* Galusha J. Bundy, Lyndon, Vermont.

Claim.—"The arrangement of the two movable gates, with the slider, the seed and fertilizer hoppers, and their discharging holes or chambers."

109. For an *Improvement in Machines for Manufacturing Felt Cloth;* Thomas B. Butler, Norwalk, Connecticut.

Claim.—"The traversing of the bat apron by traversing the apron drum independently, and in connexion with a traverse of the frame. Also, the traverse of the apron, in combination with a simultaneous opposite traverse of the transfer roll."

110. For an *Improved Sawing Mill;* William M. Ferry, Jr., Ferrysburg, Michigan.

Claim.—"1st, Arranging the saw arbor and all the parts bearing a close relation to the saw on a metal yoke, and making said yoke capable of being adjusted so as to stand slightly out of parallel with the edge of the carriage. 2d, Constructing the saw spindle with circular flanch, and the common saw collar which surrounds the eye of the saw with a T shaped socket of greater length than the flanch, so that the saw may have slight end play independent of bearings, spindle, or gearing. 3d, The application of the adjustable self-fastening trip to a saw mill, which operates with a continuous rapid motion back and forth for operation, in combination with the vibrating reversing stop."

111. For an *Improved Apparatus for Making Acid Sulphate of Lime;* Laurent Gaumotis and Sabin Martin, New Orleans, Louisiana.

Claim —"The process of making bi-sulphate of lime by means of furnace and cisterns."

112. For an *Improvement in Rotating Harrows;* James B. Gascock, Fancy Creek, Illinois.

Claim.—"Causing the after end of the pivoted draft bar to bear upon the upper surface of the rotating tooth frame, in such a manner as to properly distribute the propelling power exerted upon said draft bar, by which I relieve the fulcrum journal from injurious warping strains, and at the same time impart a steady and uniform movement to said tooth frame as it is drawn forward."

113. For an *Improvement in Corn Harvesters;* G. D. Haworth, Mechanicsburg, Ill.

Claim.—"The cutters attached to suspended rods, the cutters curved and working underneath stationary teeth or fingers."

114. For an *Improvement in Feed Rollers of Planing Machines, &c.;* Jonathan Hall, Worcester, Massachusetts.

Claim.—"The application and use of internal gearing. Also, in combination therewith the arrangement of the movable box and connecting bridle, or their equivalent."

115. For an *Improved Arrangement of Means for Regulating the Fire of Coal Burning Locomotives;* John M. Hartnett, Wawkegan, Illinois.

Claim.—"The fan placed within the box connected with the pipes provided with valves."

116. For an *Improvement in Tension Apparatus for Sewing Machines;* Abraham Hoagland, Jersey City, New Jersey.

Claim.—"The use of two elastic wheels or rollers (governed by the saddle and thumb screw), between and around which the thread is passed to give it any required tension in sewing."

117. For an *Improvement in Signal or Alarm Bells;* George H. Hoagland, Port Jervis, New York.

Claim.—"The use of the reel, for the purpose of striking the bell for a signal, or ringing continuously for alarm. Also, the combination of the reel with the hammer and belt."

118. For an *Improvement in Shovel, Spade, or Dung-fork Handles;* George C. Howard, Hardwick, Massachusetts.

Claim.—"My improved manufacture of shovel handle as made with a split and bent stock, and a round holder applied and fixed together by concavities in the ends of the holder, convexities on the arms of the eye, and a rod and metallic caps arranged and fixed together."

119. For an *Improved Metallic Bridge for Piano-Fortes;* G. Henry Hulskamp, Troy, New York.

Claim.—"1st, The sounding board bridge cast of metal, with two bearings above

the string, one on each side of the bottom support. 2d, The rod or wire, or its equivalent, inserted in the bridge to form its bearing surface. 3d, The construction and arrangement of the cast metal bridge, in such form that it may be detached and yet firmly held in its place."

120. For an *Improvement in Hog Troughs;* Elmore Johnson, Winchester, Mass.

Claim.—"An elongated trough or bowl and a quadrantal cover, arranged or applied together, and an opening in a frame, wall, or the side of a pen or sty."

121. For an *Improved Sawing Mill;* Franklin B. Kendall, Bath, Maine.

Claim.—"The general arrangement thereof."

122. For an *Improvement in Corn Planters;* Norman A. Lewis, Glenn's Falls, New York.

Claim.—"Having the slides placed over the ends or orifices of the conveying tubes, the slides being attached to the ends of the same rod, and operating said rod by means of the curved incline attached to the rod or bar, and the pulley or roller attached to the rod, whereby the slides are actuated or opened and closed alternately. Further, the hoe attached to the frame which is placed within the roller frame, arranged and operated by the projections on the driving-wheel."

123. For an *Improvement in Bagasse Furnaces;* George M. Longacre, New Orleans, Louisiana.

Claim.—"The construction of bagasse furnaces with a space around and communicating with the upper portion of the fuel chamber, and leading to an exit flue, regulated by a damper, when said parts are additional to the ordinary channels for the passage of the products of combustion."

124. For an *Improved Hand Wrench;* George B. Phillips, Albany, New York.

Claim.—"In combination with the jaws the arrangement for regulating the space between the jaws, and securing them when so adjusted, that is to say, by the employment of toothed blocks operated alternately upon teeth in the upper jaw by the spring and saddle, or their equivalents, so as to regulate the space to distances differing by half the spaces between the teeth."

125. For an *Improvement in Railroad Car Couplings;* Wellington Prosser, Kendall, New York.

Claim.—"The combination of the jaws, hoop, or band, and link or shackle bar. It being understood that I do not claim the combination of the jaws with the link alone, but the combination of these two elements with the band."

126. For an *Improved Method of Turning Carriage Hubs;* Alexander Rickart, Schoharie, New York.

Claim.—"The frame placed on the driving or power shaft, and connected with the mandrel by the arms, the frame being provided with the gearing to connect the shaft with the mandrel, which mandrel is placed on the sliding carriage, when the above parts are used in connexion with the rotating cutter head."

127. For an *Improvement in Governor for Water, Steam, and other power;* Nathan Scholfield, Norwich, Connecticut.

Claim.—"The application of a compensating adjustment for so changing the normal or medium rate of action of a governor or regulator while in action, to rectify a disturbed motion, that it shall cease to act on the supply of the motive power while the speed of the wheel or machinery is returning from any extreme of variation, and before reaching its proper rate or that in which its action commenced; and also that it may commence a reverse action thereon, to counteract or anticipate any excess thereof, if the return of the speed is so rapid as to induce a tendency to pass its proper medium."

128 For an *Improvement in Garden Hoes;* Solomon Shetter, Allegheny, Penna.

Claim.—"Cutting and forming hoe blades out of sheet iron or steel with side edges and prongs."

129. For an *Improvement in Cotton and Cane Cultivators;* Thomas E. Shannon, Woodville, Mississippi.

Claim.—"The combination with the wheel carriage of a series or gang of revolving cultivators."

130. For an *Improvement in Straw Cutters;* Jonathan L. Sullivan, Lexington, North Carolina.

Claim.—"The two sets of knives and slotted plate, combined and arranged so as to operate conjointly."

131. For an *Improvement in Roofing Compositions;* John B. Wands, Chicago, Ill.

Claim.—"The combination of the various ingredients."

132. For an *Improvement in Means of Stopping Shot Holes in Vessels;* John Woodville, Chillicothe, Ohio.

"This invention consists in the arrangement of the means for stopping the shot holes in vessels of war."

Claim.—"1st, The arrangement of the disk formed of india rubber and whalebone slats, the rigid bar, the jointed rod, the chains or cords, and the springs, relatively to one another. 2d, The arrangement on the bar of the slide, the tubular rod, the slide, with catch, the rod, and the straps, relatively to one another, and to the disk and its attachments."

133. For an *Improvement in Grain Separators;* William Zimmerman, Quincy, Ill.

Claim.—"The perforated rotating disk with its diamond-shaped ring, or its equivalent, on the same shaft with the fan, arranged and operated so as to throw the grain by centrifugal force into the blast pipe horizontally. Also, the cheat box around the suction pipe, in combination with the tunnel-shaped delivering tube and spreader, so as to make the grain descend through the blast of air, and through a tunnel-shaped pipe over the spreader. Also, a conical plug arranged so that it can be adjusted in the suction pipe, to graduate the flow of the blast in the suction pipe, and regulate it as desired."

134. For an *Improvement in Retort Covers;* James R. Floyd, Assignor to Theodore C. Kibbe, City of New York.

Claim.—"The constructing gas retort covers of malleable iron."

135. For an *Improved Means for Rendering Joints Steam-tight;* William S. Gale, Assignor to Peter Pillon, City of New York.

"This invention consists of a grooved or corrugated surface with an opposing smooth or plane surface."

Claim.—"The method of causing steam to become a packing to itself in steam cylinders, or other parts of steam machinery, by allowing the steam to act in one or more grooves."

136. For an *Improvement in Machines for Digging Potatoes;* Joseph Heulings, Assignor to self, W. H. Lawson, and B. M. Heulings, Philadelphia, Pennsylvania.

Claim.—"The combination of the rotary diggers, oscillating frame, and oblique stalk cutter."

137. For an *Improvement in Diaper Pins;* J. Heilman, Assignor to Ignatius Sturn, City of New York.

Claim.—"The tube, having the slide fitted within it, the slide being attached to one end of the tube by a spring formed of india rubber, or other suitable material, and the hook attached to the slide, the tube being slotted longitudinally."

138. For an *Improvement in Photography;* Henry A., Assignor to Edward D. Marchant, Philadelphia, Pennsylvania.

Claim.—"The rendering of the picture transparent, and attaching the same to glass in a permanent and secure manner, by means of a mixture applied under heat and pressure."

139. For an *Improvement in Spark Arresters;* John F. Page, Assignor to self and James Landy, Philadelphia, Pennsylvania.

Claim.—"The arrangement of parts relatively to one another, so as to effectually arrest the sparks of a locomotive without obstructing the draft."

140. For an *Improvement in Cylindrical Door Bolts;* Charles G. Page, Washington, D. C.

Claim.—"The oblique slot in the guard, in combination with the lever or handle of

the bolt working in said slot. Also, the zigzag or return slots in the guard, by which the bolt is carried through its range by the two movements of raising and depressing the handle."

JULY 28.

141. For an *Improved Feeding Arrangement for Sawing Machines;* Thomas J. Alexander, Westerville, Ohio.

Claim.—"The combination and arrangement with a reciprocating feed carriage as a means of operating the same, to effect the reciprocating travel or feed by propelling gear therein, or connected therewith, operated by or from a main feed shaft of the freely sliding or self-adjusting pulley frame, with its right and left hand belts driven and communicating motion to the main feed shaft."

142. For an *Improved Method of Driving Circular Saws;* Thomas J. Alexander, Westerville, Ohio.

Claim.—"The combination and arrangement with a revolving saw or cutter, having either a fixed or reciprocating relationship or action in the path of its cut, of the freely sliding or self-adjusting loose pulley carrying frame, made whole or divided and rigid or self-stretching, with its loose pulleys, right and left hand belts and pulleys, of the saw and counter shafts."

143. For an *Improvement in Governors for Regulating the Work of Wind-Mills, &c.;* Ethan Allen, Worcester, Massachusetts.

Claim.—"In combination with the adjustable or expanding crank, the projection attached to the slide of the crank pin, the sliding rod upon which it acts, for the purpose of engaging a grooved collar upon the spindle of the governor, whereby its adjusting power is confined within a certain proper range."

144. For an *Improved Fuse-making Machine;* Albert F. Andrews, Aron, Conn.

Claim.—"1st, The admission of a blast of compressed air upon, into, among, or through the powder on its way through the passage or channel, by which it is conveyed to the fuse. 2d, Giving the feeding tube a rotary motion outside of a conducting tube, and inside a laying piece, both of which are stationary."

145. For an *Improvement in Segmental Truss for Bridges, &c.;* George S. Avery, Lewisboro', New York.

Claim.—"An improvement in segmental truss bridges, by a combination of the arched top chord, horizontal bottom chord, braces, vertical tie rods, packing blocks, and self-adjusting shoes, the whole constructed into a segmental truss of greater strength and stability than such as are generally used with the same amount of building material. Also, the combined arrangement of the different parts."

146. For an *Improvement in Pill Machines;* James C. Ayer, Lowell, Massachusetts.

Claim.—"The corrugated or grooved globule cylinders, or their equivalents, for forming the rods of 'mass' or semi-solid material into globules. Also, the cylinder plunger and screw, for forming the round rods of the desired size. Also, the knife, or its equivalent, for cutting the rods of semi-solid substance the desired length, so arranged that it will cut or sever the rods without its sticking to them."

147. For an *Improved Automatic Lathe for Turning Irregular Forms;* Samuel N. Baker, New Haven, Connecticut.

"This invention relates to the use of a series of cutters attached to a moving head, operated and moved to form the configurations upon the article being turned in the lathe, to which the head is attached by revolving the pattern dies against the cutters, or by revolving the cutters against the pattern dies, and giving to the head containing the cutters a motion in the line of the length of the article being turned, for the purpose of giving to the article the required shape through the combined movement of the head and the cutters."

Claim.—"1st, The use of a series of cutters secured to a cutting head, standing at right angles to the article being turned, the said cutters being operated by being revolved within the circular case. 2d, The use of a pattern guide or die, or a series of them, placed at right angles to the article being turned, within a circle struck from the 'centre' of the lathe, and having a movement in the direction of the length of the lathe coinci-

dent with that of the cutters, and against which the cutters in their revolution come in contact. 3d, The use of a sliding cutter head containing both the cutters, to perform the operation of turning, and the pattern dies or guides to control the movements of the cutters."

148. For an *Improvement in Tanning Compositions;* Ira Carle, Kingston Township, Pennsylvania.

Claim.—"The use of hemlock or oak bark, nitric acid, and Glauber's salts, all to be used in one bath for the purpose of tanning leather from hides in a short space of time."

149. For an *Improved Auger Handle Fastening;* William N. Clark, Chester, Conn.

Claim.—"The attachment of the nut to the handle of the auger, for the purpose of preventing the parts from being lost, and to form a secure and convenient fastening."

150. For an *Improvement in Smut Machines;* Everard M. Clark, Lancaster, Penna.

Claim.—"The shape and construction of the fluted propeller, for the purpose of scouring the grain, at the same time driving a blast upwards, so as to blow off the cheat, smut, &c., out of the spout above, before the grain passes down on to the wings of the propeller and concave."

151. For an *Improvement in Adjustments applied to Pendulum Levels;* Calvin Cole, Tarrytown, New York.

Claim.—"1st, The adjusting platform with its attached set screw and spring. 2d, The adjustment of the dial plate around the axis of the pendulum by the set-screws."

152. For an *Improvement in Artificial Legs;* R. H. Nicholas and Douglass Bly, Rochester, New York.

Claim.—"The use of the ball, the two sections of the limb being held together."

153. For an *Improved Method of Sawing Staves from the Bolt, and Dressing their Edges simultaneously;* Elisha K. Collins, Cambridge, Mass.

Claim.—"The hand saw or saws, endless chain, which gives a continuous feed motion to one or more beds or plates attached, curved bars, the rotating cutters, the racks and the gearing, and screws connected with the bar, when they are arranged and combined to operate conjointly for the purpose of sawing, jointing, and dressing staves at one operation."

154. For an *Improved Machine for Tempering Scythes;* C. P. Crossman, Warren, Massachusetts.

Claim.—"The employment within a suitable water tank of a pair of movable jaws and boxes, for the purpose of seizing, holding, and conveying the scythe blade."

155. For an *Improved Shell-roller Bed for Planing Machines;* George Darby and James E. Young, Augusta, Maine.

Claim.—"The combination of the hollow or shell-rollers with the bevel grooved rollers, whereby a bevel grooved or straight bed is formed."

156. For an *Improved Machine for Seaming Sheet Metal Roofs;* Lucian Fay, Cincinnati, Ohio.

Claim.—"The use of the burning, folding, and seaming rollers, constructed with or without adjustable elastic bearings, in connexion with the movable platform or carriage."

157. For an *Improvement in Spark Arresters;* Henry H. Graham, Paterson, New Jersey.

Claim.—"Placing the slats in the vertical sides of the radial spark conductors at a higher elevation than the screens connecting the bases of said conductors, and with the mouths between said slats opening toward the angle between said spark conductors, and in the opposite direction to the accelerated motion of the products of combustion."

158. For an *Improved Machine for Punching and Shaping Metals;* George Haseltine, Washington, D. C.

"This invention consists in the employment of dies and punches, so arranged and operated that the required metal is cut from the bar or rod, shaped and punched, without waste of material, and the completed article discharged from the die box at every revolution of the shaft."

Claim.—"1st, The punch in connexion with the punch. 2d, The movable dies when used in combination with two punches."

159. For an *Improvement in Mop Heads;* James S. Harris, East Poultney, N. Y.

Claim.—"Constructing the wire jaws so as to nearly or quite inclose oblong spaces, for the purpose of more effectually embracing and holding the cloth. Also, the pin when used in combination with the jaws."

160. For an *Improved Mortising Chisel;* Christian J. Heistand, Rapho, Penna.

"This invention consists in providing the chisel with an eye, for the reception of a long handle."

Claim.—"The new article of manufacture consisting of a chisel with a handle placed at right angles with the cutting part."

CIVIL ENGINEERING.*

For the Journal of the Franklin Institute.

Improvement of the Ohio River. By CHARLES ELLET, Jr., Civ. Eng.

I have no wish to participate in the discussion now going on in the pages of the *Journal*, of the merits and faults of the various suggestions for the improvement of the navigation of the Ohio River. My object, at this time, is merely to invite the attention of Mr. W. Milnor Roberts to an error in his communication in the September number of the *Journal*, which, when corrected, I think will cause him to withdraw his modification of the plan of "Low dams with open sluice ways."

Mr. Roberts seems already to have condemned Mr. Haupt's plan of low dams with canals along shore; which, indeed, Mr. Morris had previously shown to be entirely impracticable. If, then, it shall appear that Mr. Roberts's modification of that plan is equally impracticable, the investigation in which he is now most laudably engaged, will be narrowed down to its former dimensions—to a choice between the system of reservoirs, and the system of locks and dams.

There will then be no other plans before the public at all worthy of consideration.

Mr. Roberts's recent plan of using reservoirs, along with low dams and open sluices, is devised expressly for the purpose of saving water—*in the supposition that a river can be made to stand on an inclined plane without being fed with the supply of water due to the slope of the plane, its depth and the length of its wetted perimeter.* This is an oversight, fatal to his modification.

The expectations of Mr. Roberts would be *approximately* satisfied, if his low dams were placed along at spaces of about a quarter of a mile, instead of every *seven miles* of the river's course.

I do not wish to enter into any detailed investigation of this problem. I am satisfied that it is only necessary to call Mr. Roberts's attention to the point, to insure a new and more correct view of the subject. He will perceive, I am sure, as soon as his mind is again brought to the question, that he cannot obtain a depth of six feet between his dams, when placed from eleven to fifteen miles apart, as he proposes, unless he provides almost the precise quantity of water that would be required to maintain a depth of six feet in the natural and unobstructed channel of the river. The only object of the 80 dams proposed by Mr. Roberts,

* The two following articles were received too late to be put in the position of this number devoted to Civil Engineering.—ED.

is to save water. But they are to be set too far apart, and will not save any ; or if any, only a quantity inappreciably small.

I am confident that Mr. Roberts will take great pleasure in correcting this error, which is obviously an oversight, and adapting his interesting paper to a sounder view of that part of his subject. This correction will materially simplify the great problem he has on hand : freeing his own mind and the channel of the Ohio at the same time, from the prospective incumbrance of 75 or 80 unnecessary dams. He will then have nothing to do but to get rid, also, of an equal number of unnecessary locks, and his path to a correct solution will be clear and easy.

For the Journal of the Franklin Institute.

Jordan Iron Bridge near Allentown, Pennsylvania.

By Ellwood Morris, Civ. Eng.

The railroad extending into the interior from the Crane Iron Works, at Catasaqua, for the conveyance of iron ore from various beds in Lehigh county, Pennsylvania—crosses the Jordan creek where the valley is nearly a quarter of a mile in width at grade, and about 1000 feet at the bottom.

The grade level at this crossing is nearly 90 feet high, above low water in the Jordan, and its valley formed a very serious obstacle to encounter upon a merely local railroad.

Proposals for an iron bridge were finally invited by the Company, and the contract assigned to F. C. Lowthrop, Esq., a civil engineer of great experience and skill.

The extreme length of the bridge is 1165 feet, and the iron superstructure consists of 11 spans, of 100 feet each. These spans are of a suspension truss, each truss being 16 feet high, and the two trusses, necessary to carry a single track railroad, being spaced 10 feet clear apart.

The trusses are supported upon a group of cast iron pillars, of cruciform section, connected and braced together in stages, and firmly stayed laterally by heavy wrought iron bracing rods bolted to the masonry.

These skeleton piers of cast and wrought iron, stand upon low piers of solid masonry, raised above the line of flood, and pointed at both ends.

The single track railway crosses upon the deck of the iron bridge, in a continuous straight line.

Early in July, this bridge—which is believed to be the longest iron structure yet erected in the United States, was tested to the entire satisfaction of the Company, with a loaded train drawn by a locomotive—the whole train weighing upon each span of 100 feet = 113 tons, *or more than one ton to the foot lineal, which was the test load contracted for.*

This bridge is now in use, and attracts crowds of visitors. It presents a very light and graceful appearance.

The first stone was laid August 27th, 1856, and the first locomotive crossed July 14th, 1857, the whole having been completed in less than a year.

This is in every sense a remarkable work, and does the highest credit to the energy and ability of the engineer and contractor, F. C. Lowthrop, Esq.

The small cost at which this wide and deep valley has been crossed by Mr. Lowthrop, will surprise many of our engineers, as much as the very short time required for its construction.

The entire cost has been less than $70 per foot run, or about $70,000 for the entire structure!

This structure demonstrates conclusively the speed and economy with which iron bridges may be erected for railway purposes, and will do much to extend their use in our country.

MECHANICS, PHYSICS, AND CHEMISTRY.

*On Soluble Glass, its Preparation and Applications.**

By J. N. von Fuchs.

(Continued from page 199.)

Undoubtedly one of the most useful applications of soluble glass is to painting, as it it is peculiarly fitted to fix colors well, and also to give great permanence to all coatings. This mode of painting is called *stereochromy* by the author; and under this term he understands those methods of painting in which soluble glass constitutes the medium for fixing the colors and their supports, in which respect stereochromy is essentially distinguished from all other kinds of painting.

In monumental painting it competes with fresco-painting, and will undoubtedly supersede it, and even attain a wider field of application. In Prussia, fresco-painting has already been given up to a great extent, and the wall-pictures in progress there are being executed by the stereochromic process. In England, also, this method has met with great acceptance. The so-called encaustic painting cannot compare with it.

The author was first led to the idea of employing soluble glass in painting by the numerous complaints of the imperfections of fresco-painting, and the general opinion that frescoes would not last in our climate. He met with great difficulties in effecting the application of soluble glass to this kind of painting, and only succeeded when he united himself with Von Kaulbach for this purpose.

Wall or Monumental-painting upon a Mortar-ground.—When a stereochromic picture is to be applied in a beautiful and permanent manner to a wall, especial care must be devoted to the material to which the work of art is to be applied, that is, to the mortar, the substratum, and the superstratum. Errors made in this may render the painting difficult, and injure the beauty of the pictures. In this, the principal problem is to give the ground an equal stony solidity throughout, and as it were to amalgamate it with the wall, but at the same time to manage that it imbibes the soluble glass well and uniformly in all parts. The first coat, or substratum, is made with ordinary lime-mortar, so as to do away with

* From the Lond. Chem. Gaz., No. 348.

the inequalities of the wall, and cover the stone well. The sand in this should be of a medium size, neither too coarse nor too fine; it is, however, of little consequence whether it be calcareous or quartz-sand, but either must be well washed before use. The properly slaked lime must be sparingly employed, in order that the mortar, which is to be made with distilled or rain-water, may be rather poor than fat. If the mortar were too fat, the soluble glass would penetrate with difficulty.

The plaster thus prepared must not only be allowed to dry well, but must also remain exposed for several days to the air, in order that it may attract carbonic acid and become converted into subcarbonate of lime; for if the lime in this mortar were still caustic, the soluble glass would be decomposed by it, and could not penetrate into the wall, which is extremely necessary if a good binding is to be effected by it.

To facilitate the impregnation of the lime with carbonic acid, a solution of carbonate of ammonia may be employed, by which the mortar acquires a greater solidity when it has been moistened with it two or three times. When it has again become quite dry and the ammonia has evaporated, the soluble glass is employed to fix it and attach it firmly to the wall; with this it is to be well soaked repeatedly, drying between each application, until it is almost saturated. The soluble glass employed for this purpose should be soda or double water glass, mixed with so much solution of silicate of soda that it may be quite clear, and not opalescent.

Soda-glass or double water-glass is to be preferred to potash water-glass, because it is absorbed better. It is not to be employed in a concentrated state, but diluted with an equal volume of water, as otherwise there is a probability that it would not penetrate into the wall. As the plaster cannot be equally thick in all parts on account of the inequalities of the wall, and the thicker parts require more soluble glass than the thinner, and consequently continue to absorb it when the latter are already saturated, the thick parts must be sought out with a moist brush, and soaked with soluble glass until they are saturated.

When the substratum is fixed in this way, the superstratum, which is to receive the picture, may soon afterwards be applied. As already stated, much depends on this being of the proper nature, if the desired object is to be attained with certainty and without difficulty.

For this purpose, the superstratum, which does not differ essentially from the substratum, should be prepared with distilled or rain-water and well-washed sand (calcareous or quartz-sand), of a particular grain, not exceeding a certain size, and kept rather poor, in order that it may not form any cracks and may be able to absorb readily. To get the sand of the proper grain, it must be passed through a sieve, such as is known in Munich as No. 9, and the meshes of which measure five Rhenish points in width.

As regards the quality of the calcareous sand, that which is artificially obtained by pounding marble or dolomite is to be preferred to natural sand, because the latter consists of roundish, and as it were ground grains, which do not bind so well as the sharper granules of the artificial calcareous sand, which possess a fresh and rough surface. The very fine powder, which is however advantageous for good binding, must be got

rid of either by lixiviation or by a fine sieve, as otherwise the mass would be rendered too compact and no longer thoroughly absorbent.

The texture of the surface of the painting ground depends principally on the size of the grains of sand; the coarser these are, the rougher will it turn out, which to a certain extent is favorable to the painting so long as the colors, which are to be applied merely with water, adhere sufficiently until the application of the soluble glass.

The surface should never be smooth or ground, because then it receives but little or none of the color without fixing media. As Von Kaulbach expresses himself, the surface must feel like a file. A distinction must also be made between pictures which are to be seen closely and those which are to be viewed from a distance; in the latter the grain of the surface may be considerably coarser than in the former, for which rather finer sand should be used.

This ground or mortar is applied as evenly as possible to the thickness of about a line upon the substratum; and when it has become dry, it is rubbed with a sharp sandstone (or, as in Berlin, with an iron ruler), in order to give the surface the proper roughness, and at the same time to remove the thin stratum of carbonate of lime formed during desiccation, which would prevent the absorption of the soluble glass.

The author, however, considers it far better to destroy the incrustation by a simple chemical agent, namely, dilute phosphoric acid (1 part of concentrated acid to 6 parts of water). A sponge soaked with this fluid, or a brush moistened with it, passed over the surface, does all that is necessary. As the phosphate of lime thus produced, binds well with soluble glass, no injury is done to the mortar thereby, and at the same time we avoid the starting of small fragments, which may take place during the mechanical rubbing, forming small holes, which require to be repaired.

When the ground is so far prepared and well dried, it is impregnated with soluble glass, in order to give it the necessary consistency and amalgamate it properly with the substratum. For this purpose, double soluble glass, rendered clear by silicate of soda and diluted with an equal quantity of water, may be employed with advantage. It will generally be sufficient to perform this operation twice, drying the mass after each application, for it must be done in moderation in order that the pores may not be closed by too much soluble glass, by which the difficulty of the painting would be considerably increased. If a mistake has been committed in this respect, the ill effects can only be got over, either by removing the mortar, or by waiting for a time before commencing the painting, until by the further contraction of the soluble glass the ground opens again of itself. This will be greatly facilitated by heat, which is most easily applied by burning spirit of wine upon the ground.

After the superstratum has been prepared either by friction or phosphoric acid, and fixed with double soluble glass, to which a little silicate of soda has been added in such a way that this has been uniformly diffused over its surface, and the ground has proved to be uniformly and thoroughly absorbent, the painting may be commenced. There is, however, no occasion to hurry with this; on the contrary, it is even well to wait for a time, because in the meanwhile the ground becomes drier, and thus the faculty of absorbing, which is absolutely necessary for the painting, is increased.

The colors are applied with pure water; and the wall is frequently syringed with pure water, in order to expel the air from its pores and assist the adhesion of the colors. This syringing, however, should be moderate, and no more than is necessary, and the greatest possible care should be taken that the neighboring parts, which are already painted, may not receive too much of it, because otherwise, as Echter remarks, the colors would lose somewhat in brilliancy; the reason of which apparently is, that by the application of too much water the finest and weakest coloring particles are washed up on the surface, and thus separated from the other more powerful ones. This undesirable result occurs especially on those places which are repeatedly painted over, and for this purpose require to be moistened. Echter, however, has found a means of entirely getting rid of this inconvenience, by brushing off these dull coloring particles, after drying and before fixation, by means of a very fine brush, after which the colors again make their appearance in their original purity.

Nothing more is then necessary than to fix the colors properly, for which purpose the soluble glass for fixing has already been indicated (at p. 123) as peculiarly applicable. It is sufficient to dilute it with one-half of water.

As, however, the colors only adhere weakly, and do not allow of the use of the brush, the soluble glass must be syringed upon them in the form of a very fine rain or cloud, and at first very cautiously, in order that the colors may not be removed from their places and run together. For this purpose, Prof. Schlotthauer, who has occupied himself much with stereochromic experiments, has invented a syringe which scarcely leaves any thing to be desired. This operation is continued, with intervals of drying, until the colors adhere so firmly that they communicate nothing to the fingers when passed over them. When white pocket-handkerchiefs, which are sometimes used for this purpose, are dirtied by strong friction, this proves nothing against the permanence of the colors, because when rubbed with a strong pressure, grains of sand are loosened, and these attack the colors, which, however, the pocket-handkerchiefs cannot do of themselves. The same thing may also be observed in fresco-paintings.

In testing the colors as to their permanence and fixity, it is sometimes found that whilst some of them are sufficiently fixed, others still appear to be more or less loose, and dirty the fingers. To these belong the so-called meagre colors, such as black. These require still more soluble glass, which must be applied to them by means of a fine pencil, until they adhere as firmly as the others. Von Kaulbach, however, has very recently stated that this occurs very rarely, as it may be obviated by a proper mixture of the colors.

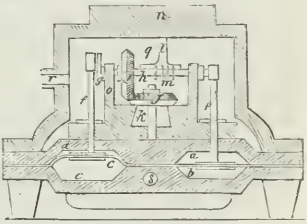
This is essentially the process by which Von Kaulbach, assisted by Echter, has executed four large stereochromic pictures in the new Royal Museum at Berlin, as to the excellence of which, especially the last, there is but one opinion.—*Abhandl. der Naturw. Commission bei der Konigl. Akad. der Wiss. zu München;* Dingler's *Polyt. Journ.* cxlii. p. 365.

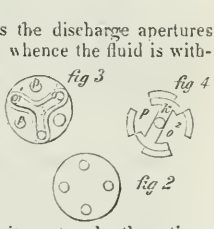
Specification of a Patent granted to JOHN RAMSBOTTOM *and* JOHN CHARLES DICKINSON, *for improvements in machinery or apparatus for measuring and registering water and other fluids, and obtaining motive power from the same.*—[Dated 30th November, 1855.] *

This invention consists principally in an improved method of regulating the passage of water to and from the measuring chambers of water metres, in such a manner, as to obtain an uniform supply and delivery, without the shock and concussion attendant upon rapid valvular changes: therefore, the structure, arrangement, and mode of actuating the valves, constitute the principal features of this invention, in connexion with certain measuring chambers, crossed by diaphragms of india-rubber, gutta-percha, metal, or other suitable flexible substance or material, so as to divide each of the chambers into two, in order that the fluid entering one chamber may press the flexible diaphragm against the side of the other chamber, and besides discharging the fluid from the latter chamber, give motion to the valve and registering apparatus by means of rods, one of which is attached to each diaphragm, and which passing through the chambers, are provided with suitable appendages to effect this motion.

Fig. 1, is a sectional elevation of one form of the apparatus. *a*, *b*, and *c*, *d*, are chambers; *e*, the diaphragms; *f*, the diaphragm rods; *g*, the cranks; *h*, the shaft; *j*, the wheels communicating with the valve *k*, and *l*, the vertical spindle, worked by the spiral screw *m*, which moves the registering apparatus contained in the box *n*. *o*, are supports for the shaft *h*. Fig. 2, shows the valve-seating, with apertures corresponding to the number of chambers; and fig. 3, the valve, which in this case, has six apertures,—three of which, o^1, o^1, o^1, are connected with the supply-pipe, and alternately constitute the feedways leading to the chambers. The other three apertures *p*, *p*, *p*, are connected alternately with the chambers, and serve as the discharge apertures therefrom, into the body of the metre *q*, from whence the fluid is withdrawn by the outlet pipe *r*. These valves may either feed and deliver at the bottom or at the sides, similarly to the one next described. Fig. 4 is a horizontal cross section of this valve, but having two apertures only; o^2 being the supply, and *p*, the delivery, shown in connexion with its seating and passages. To cause this valve to be similar in effect to a valve of six apertures, it must make three times the number of revolutions. It will be readily seen that when rotary motion is imparted to these valves, the feed and exit ways change suc-

Fig. 1.





* From Newton's Lond. Journ., January, 1857.

cessively,—the diminishing supply and exit in one set of chambers being accompanied with increasing supply and delivery in another set of chambers.

Fig. 5.

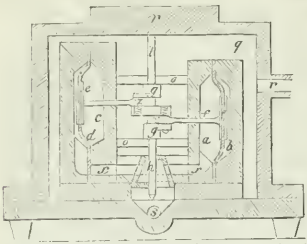


Fig. 5 exhibits another arrangement of this principle, in which chambers and diaphragms are situated perpendicularly, with the horizontal rods standing opposite to each other when two are used, and at right angles should four diaphragms be preferred. The motion in either of the above forms of apparatus may be communicated directly to the cranks by slotted cross-heads *z*, being fixed to the ends of the diaphragm rods, in which slots the crank-pins move laterally during their revolution. *x*, *x*, show the direction of the feed and exit ways.

The mechanical action or the mode of operation is as follows:—The fluid enters the feedways *s*, and after passing the valve and suitably constructed ways, enters one of the chambers (say *a*, fig. 1), presses down the diaphragm and rod, and gives motion to the crank-shaft, valve, and registering apparatus; the fluid being discharged from the chamber *b*, through one of the exit ports of the valve into the air vessel *q*; and as this motion brings the feedways into communication with the chamber *d*, the diaphragm of this chamber commences to descend, and so the motion is continued; the fluid being supplied to and discharged from each of the four chambers alternately; the supply having commenced in one chamber some time before it is cut off from another; and as there are two or more diaphragms and rods, continuous motion, with uniform supply and delivery, is obtained. To prevent rust, it is proposed to deposit a coating of gutta-percha on the interior of these metres.

The patentees claim, "Firstly,—the principle of actuating any description of valve or valves in a gradual and continuous manner, by means of two or more diaphragms, as described. Secondly,—the application to diaphragm metres of an air vessel, into which the fluid shall pass from the measuring chambers previously to its withdrawal for use. And, thirdly,—the construction and use of the within described valve, together with the general principle and arrangement, for the purpose of measuring and obtaining motive power from water and other fluids or vapors.

Specification of a Patent granted to Joseph Sturge, *of Kennington, and* Alfred Sturge, *of Northfleet, for improvements in rotary fluid metres.* [Dated 13th March, 1856.]*

The first part of this invention consists in adapting a modification of a screw in such a manner that its revolutions on its axis shall be the measure of the quantity of fluid passing through a tube or case. Second-

* From Newton's Lond. Journal, January, 1857.

ly, the invention consists in so forming the tube or case, that the fluid shall pass in straight or nearly straight lines through it—causing the revolutions of the screw vanes to be a correct measure of the quantity of fluid passing.

Fig. 1, is a section of the improved metre; and fig. 2, is a detached view of the screw. *a*, *a*, are a series of vanes forming portions of a screw; the spindle to which these vanes are attached is placed perpendicularly in a cylindrical case *b*, rather larger in diameter than the diameter of the screw: the lower end of the spindle rests upon a step, upon which it freely turns, and the other end passes through the top of the case, and is furnished with a worm for communicating motion to the registering apparatus. The upper end of the spindle is furnished either with a collar, which works against the top of the case, or with the centre at the extreme end of the spindle.

fig. 1.

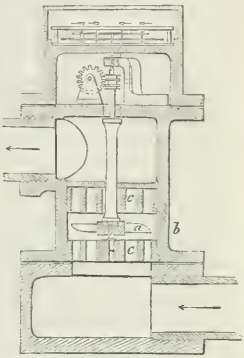


fig 2

The screw can be made by casting the whole of the metal in a mould properly struck, or by stamping each separate vane in a die or dies, and afterwards connecting them to the spindle, by means of a metal boss or central block cast on to them. The case consists of a cylinder *b*, into the upper and lower end of which is introduced a perforated plate or grating *c*. A centre of metal or other suitable hard material for the spindle to revolve upon is fixed either to the lower perforated plate or grating, or to the bottom of the cylinder: the upper plate or grating, as also the top of the cylinder, has a hole in the centre to allow the spindle to pass freely through it. The worm, or the spindle, and the works immediately connected, are covered by a close-fitting cap or cover, which can be filled with oil, and on the top of which are affixed the dials for registering the quantity of fluid passing through the metre. The fluid is admitted underneath the lower perforated plate or grating, and comes in contact with the screw, causing it to revolve and register the amount of water passed through the metre; the fluid then ascends through the upper plate or grating, and whatever motion it may have is changed into a perpendicular motion by passing through the perforated plates or gratings.

The patentees' claims are,—"The use of a blade or blades forming a part or parts of a screw of one or more threads, the axis of which is placed perpendicularly in a chamber through which a column of liquid is made to flow. Secondly,—we claim the use of perforated plates or gratings placed at the upper or lower ends of the case, or both, causing the fluid to flow in perpendicular lines; but we do not confine ourselves to the shape or dimension of the perforations or openings, or, in all cases, to the use of both of the plates; and we prefer that the length of the perforations should be at least twice their diameter."

Infringement of Howe's Patent for Sewing Machines.—Court of Queen's Bench, Guildhall, Saturday, June 27th, 1857, *before Lord Campbell and a Special Jury.—Thomas* vs. *Reynolds.**

This was an action for the alleged infringement by the defendant, who is a stay manufacturer at Birmingham, of a patent granted to the plaintiff, Mr. W. Thomas, of Cheapside, on the 1st of December, 1846, for "improvements in machinery for sewing or stitching various fabrics." Sir F. Thesiger, Mr. Webster, and Mr. Salter, were Counsel for the plaintiff; and Mr. Atherton, Q.C., Mr. Hugh Hill, Q.C., and Mr. Hindmarch, for the defendant. Prior to the introduction of this patented machinery, which was the invention of an ingenious mechanic, Mr. Howe, of New York, it appears that attempts had been made to embroider or ornament fabrics by working in stitches by mechanical means; and it had also been proposed to unite fabrics by needles and hooks operated by mechanism; but until the introduction of Mr. Howe's invention into this country, no practically useful sewing machine had been seen in England. The plaintiff being largely engaged in the manufacture of goods in which sewing was employed, had the machine brought to his notice, and considering it might be made available for some branches of his business, invited the inventor to this country, and engaged him to adapt his invention to the sewing of stays, which, at that time, were covered with ornamental stitching. This he effected by the use of a traversing frame, which held the work distended, and passed it under the action of the sewing instruments. The sewing machine proper, which formed the chief part of the patent, and which is now known as the "shuttle machine," consists mainly of a grooved needle with an eye near the point to receive a thread, and a shuttle, which in its traverse lays a thread in the loops formed by the needle thread, at the back or front face of the cloth under operation. The needle is connected to and operated by a rock lever, which causes it to pierce and carry the thread through the cloth, and then moves back out of the cloth. During this latter movement, the needle draws its thread into the form of a slack loop, and at that moment the shuttle is driven through the loop and caused to lay a thread in that loop; by which means the loop, on the completion of the return motion of the needle, is retained on the face of the cloth, and a secure stitch is produced. The cloth is then traversed forward the distance of one stitch in length, and the above described action is repeated. While under the action of the needle, the cloth is retained between two metal plates, which greatly facilitate the operations of the needle, and thereby insuring good work. It appeared that machines, possessing some of the essential features of Thomas's machine, had been extensively manufactured in the United States, and imported into this country by Messrs. Grover & Baker, of New York, who were licensees under Howe's American patent, and that, among others, the defendant had purchased such machines and employed them in his business. Attempts had been made to serve Mr. Baker with a notice of action, but failing this, the defendant Rey-

* From Newton's Lond. Jour., August, 1857.

nolds had been sued, and Baker had voluntarily become a party to the suit.

For the defence, it was not attempted to deny the infringement, but the validity of the patent was questioned, on the ground of want of novelty, from the publication of material parts of the plaintiff's invention in the specifications of some eight patents of prior date to the plaintiff's. Of these, the defendant relied mainly on a patent granted to John Duncan, in the year 1804, for a new mode of tambouring or raising flowers, figures, or other ornamental figures upon muslins, &c.; and on another patent granted to Messrs. Fisher & Gibbons in the year 1844, for improvements in the manufacture of figured or ornamented lace, or net, or other fabrics. In Duncan's specification a traversing frame was shown, for holding the cloth at tension, and presenting it to the action of a series of needles and hooks, which were thus enabled to form isolated patterns all over the fabric. This was proved by plaintiff's witnesses to be distinct from his frame, inasmuch as the traverse of Duncan's frame was necessarily limited, to suit the special work required; whereas the plaintiff's would traverse the fabric so as to form a row of stitches from selvage to selvage. And further, Duncan's frame required to be moved by hand after each stitch, while plaintiff's was self-acting, and dependent on the movement of the needle and shuttle. With respect to Fisher & Gibbons's specification, it was contended that that disclosed the use of the needle and shuttle, which formed the second claim under the plaintiff's patent. It was, however, shown by the plaintiff's witnesses, that there was a material difference between the two arrangements. That besides the one having a series of needles attached to a common bar, while in the other there was but one needle, —the form of Fisher & Gibbons's needle was inapplicable to the sewing of seams, and could only be used in connexion with open fabrics like lace. The needle stem was bowed, to allow the shuttle to pass between it and the thread; and it was provided with two eyes, through which the thread passed, and by which it was held across the bow. No slack loop was therefore produced for the shuttle to pass through, as in the plaintiff's arrangement, and moreover, the needle-bar required to receive an irregular or shogging motion, in order to pass the needles through the fabric without tearing it. The form of the stitch was the same in both arrangements, but the mode of producing it was very different. The evidence for the defence went to prove the similarity of Duncan's and the plaintiff's frame for holding and traversing the work, and the anticipation by Fisher & Gibbons of the plaintiff's claim for the needle and shuttle; their specifications having contemplated, in express terms, the sewing of two fabrics together.

The leading counsel having addressed the jury on behalf of their respective clients, the learned judge summed up as follows:—

Summing up.—Lord Campbell.—Gentlemen of the jury, this is an action substantially against Mr. Baker, and I am sorry to be obliged to say, that I do not think he appears before you to-day to very great advantage. A countryman of his, Mr. Howe, is the inventor of a most useful machine; and I must say, that our brethren in America distinguish themselves in every department of human genius, and in none

more remarkably than in invention. Mr. Howe has discovered a sewing machine, the operation of which you have observed, and which seems greatly to improve the material advantages of mankind. It is sold to the plaintiff, who, according to our law, takes out a fresh patent for it,—it never having been practised in England before. The plaintiff is, as far as we can see, in the undisturbed possession of it for ten long years; and then Mr. Baker, of the firm of Grover & Baker, makes an invasion, I must call it, into this country, and sends machines, which were clearly framed according to Howe's invention, and upon which machines Howe's name is actually put; and they sell these machines in Birmingham and other parts of England,—they, no doubt, well knowing that Howe's patent had been purchased by Thomas, and that Thomas had been in the possession of it. Then, notice being served upon Mr. Baker that he would be sued, he leaves this country. Then the plaintiff reluctantly, but necessarily, brings an action against this stay-maker at Birmingham, who was using the machine. Nobody can blame the stay-maker morally; he bought the machine and paid for it, and was using it, but it was necessary to sue him; and then Mr. Baker comes in to defend, and what defence does he set up? Why, first, that he had not infringed Howe's patent, but had made a difference, and therefore that there was no infringement, even if Howe's patent had been valid, he having put upon the machines that he sold the name of Howe. Then his counsel, most able, most learned, and most eloquent, feels that it would not be decent to ask you, a jury of Englishmen, to say that it is not an infringement, when Baker proclaimed to all the world that it was Howe's. It is allowed that there is an infringement, and that if the patent is valid, your verdict must be for the plaintiff. Then it was attempted to be shown, that there was no novelty in Howe's invention which Thomas purchased; and the various specifications that are given notice of are eight in number, but only two are now relied upon; and it is for you to say whether, hearing the evidence and giving all due effect to it, taking care that no bias upon your minds should mislead your judgment, it is for you to say, upon the evidence, and upon listening to the forcible observations you have heard from Mr. Baker's counsel, whether it is proved, to your satisfaction, that either claims No. 2 or No. 3, had been anticipated—had No. 2 been anticipated by Fisher & Gibbons, and No. 3 by Duncan. Now, gentlemen, I was called upon to give an opinion about it;—I think it is a pure question of fact for the jury;—you are the constitutional judges of it, and I beg that you will be governed by your own opinion upon it: I shall merely read to you the claims of No. 2 and No. 3.

No. 2 is amended by a disclaimer, and I ask you to consider what evidence has been given on one side and on the other. No. 2 is in these words: "I claim the application of a shuttle in combination with a needle, as shown in sheet 1 of the drawings." Not several shuttles and needles, but as shown in No. 1 of the drawings; and not for all purposes, but for "forming and securing loops of threads or other substances for the purpose of producing stitches, either to unite or ornament various fabrics, whatever may be the means employed for working such shuttle and needle when employed together." Then, in the disclaimer,

he adds, "I do not claim the use in a machine of several needles and shuttles, nor do I claim any of the mechanical parts, separately, of which the machinery shown in the drawings is composed."

Now, gentlemen, Mr. Carpmael and the witnesses on the part of the plaintiff have said, that Fisher & Gibbons's is essentially different from this No. 2 in Mr. Thomas's specification, and they have given you their reasons. Then, on the other side, there have been witnesses who have stated, very positively, that they are the same: form your own opinion upon it; and though it is a question of fact, and you will be governed by your own opinion, I cannot help saying, that, in my judgment upon the matter, the evidence preponderates in favor of the plaintiff, but do not be governed by that. Then the claim, which is the second ground of objection is, "I claim the construction and use of the sliding frame shown in sheet 2 of the drawings, whereby I am enabled to hold the cloth in such a manner that it can be moved in any required direction to receive straight and curved lines of stitches, and also stitches that will form various patterns of embroidery." Now, it is said that Duncan's machine describes this. It is for you to form your own opinion upon that. I should have thought that Duncan's machine could not properly be called a sewing machine; but that is a matter of fact for your consideration. Mr. Carpmael, and the witnesses for the plaintiff, have stated that it is essentially different from what is stated in No. 3. The defendant's witnesses you have heard, and I must own I was a little surprised to hear that they considered that Duncan's was a sewing machine; but if it be a sewing machine, it is very wonderful that from the year 1804 to the year of grace, 1846, there was no practically useful sewing machine, either in England or America. But one of the witnesses said that a workman reading Duncan's specification would at once find that it was a sewing machine. It is to be regretted that the world for forty years lost the advantage of such a happy invention. But, gentlemen, if you think it is substantially the same, although Mr. Howe did not copy it, or Mr. Thomas did not copy it, the law is, that being substantially the same, and being so disclosed by the specification of 1804, the patent would be invalid. But I cannot help owning that I was a little surprised to hear that they could be the same, if it was necessary in the one always to stop and re-adjust the machine for any change in the pattern; whereas the other could go on and change the fabric to be sewn exactly according to the will of the workman who was superintending the machine. That would have constituted, as one would think, a material difference between them: but one of the witnesses says that that might be done even in Duncan's; that Duncan's will work vertically, laterally, and horizontally. That is contrary to the evidence given on the part of the plaintiff; but you must form your own opinion. If you think that this really was substantially the same, though unknown to Howe, and although it slept for nearly half a century, if it be substantially the same as that which is described in the claim No. 3 of Howe's invention or Thomas's patent, then your verdict upon that will be for the defendant; but if you think there is no satisfactory evidence given to you to show that either No. 2 or No. 3 had been anticipated—that Fisher & Gibbons's patent and Duncan's are materially different from the

description of the claim, either in No. 2 or in No. 3,—then your verdict will be for the plaintiff.

The jury deliberated for a few minutes.

The Foreman.—The jury find a verdict for the plaintiff.

Sir F. Thesiger.—Damages forty shillings. Your Lordship will give the usual certificates.

Lord Campbell.—All certificates.

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*On the Laws of Color.**

[Proceedings of the Royal Institution of Great Britain.]

Mr. Grace Calvert stated that he had three objects in view in this discourse. The first was to make known the laws of color, as discovered by his learned master, M. Chevreul; secondly, to explain their importance in a scientific point of view; and, thirdly, their value to arts and manufactures.

To understand the laws of colors, it is necessary to know the composition of light: Newton was the first person who gave to the world any statement relative to the components of light, which he said consisted of seven colors—red, orange, yellow, green, blue, indigo, and violet. It is now distinctly proved that four of these seven colors of the spectrum are the result of the combination of the three colors now known as the primitive colors, viz: red, blue, and yellow. Thus blue and red combined produce purple or indigo; blue and yellow, green while red and yellow produce orange: these facts being known, it is easy to prove that there are not seven, but three primitive, and four secondary, called complementary colors.

Several proofs can be given that light is composed of three colors only. One of the most simple consists in placing pieces of blue, red, and yellow papers on a circular disk, and rotating it rapidly; the effect to the eye being to produce a disk of white light. If, therefore, the eye can be deceived so readily while the disk travels at so slow a rate, what must necessarily be the case when it is remembered that light proceeds at the rate of 190,000 miles per second?

The rapidity with which light travels is such that the eye is not able to perceive either the blue, red, or yellow, the nerves of the retina not being sensitive enough to receive and convey successively to the mind the three or seven colors of which the light is composed.

Before entering into the laws of color, Mr. Grace Calvert stated that it might be interesting to know what scientific minds had devoted attention to the laws of colors.

Buffon followed Newton, and his researches had special reference to what M. Chevreul had called the "successive contrasts" of colors.

Father Scherffer, a monk, also wrote on the laws of color. Goethe, the poet, also brought his mind to bear upon the subject, and studied it to a great extent. Count Rumford, about the end of the eighteenth century, published several memoirs on the laws of colors. He explained very satisfactorily the "successive" contrast, and arrived at some in-

* From the Lond. Artizan, Aug., 1857.

sight into the "simultaneous" one; still he did not lay down its real laws.

Prieur, Leblanc, Harris, and Field, were also writers of most interesting works on this subject. The reason that they did not arrive at the definite laws of color was because they had not divided those laws into successive, simultaneous, and mixed contrasts. These form the basis of the practical laws of color, and the honor of their discovery is due to M. Chevreul.

The reason why a surface appears white or brilliant is, that a large portion of the light which falls on its surface is reflected on the retina, and in such a quantity as gives to the surface a brilliant aspect; whilst in plain white surfaces, the rays of light being diffused in all directions, and a small portion only arriving to the eye, the surface does not appear brilliant. The influence of colors on these two kinds of surfaces is very different, as may be perceived by the examples round the room, showing the influence of different colors on gold ornaments. When rays of light, instead of being reflected, are absorbed by a surface or substance, it appears black; therefore white and black are not colors, as they are due to the reflection or absorption of undecomposed light. It is easy to understand why a surface appears blue; it is due to the property which the surface has to reflect only blue rays, whilst it absorbs the yellow and red rays; and if a certain portion of light is reflected with one of the colored rays it will decrease its intensity; thus, red rays with white ones produce pink. On the contrary, if a quantity of undecomposed light is absorbed, black is produced, which, by tarnishing the color and making it appear darker, generates dark reds, blues, or yellows. The secondary colors are produced by one of the primitive colors being absorbed, and the two others reflected; for example, if red be absorbed, and blue and yellow reflected, the surface appears green. There are two reasons why a perfect blue, yellow, red, cannot be seen, &c. The first is, that surfaces cannot entirely absorb one or two rays and reflect the others. The second is, that when the retina receives the impression of one color, immediately its complementary color is generated; thus, if a blue circle is placed on a perfectly gray surface, an orange hue will be perceived round it; if an orange circle, round it will be noticed a bluish tint; if a red circle, a green; if a greenish yellow circle, a violet; if an orange yellow circle, an indigo; and so on.

The "successive" contrast has long been known; and it consists in the fact that on looking steadfastly for a few minutes on a red surface fixed on a white sheet of paper, and then carrying the eye to another white sheet of paper, there will be perceived on it not a red, but a *green* one; if green, *red;* if purple, *yellow;* if blue, *orange*.

The "simultaneous" contrast is the most interesting and useful to be acquainted with. When two colored surfaces are in juxtaposition, they mutually influence each other,—favorably, if harmonizing colors, or in a contrary manner if discordant; and in such proportion in either case as to be in exact ratio with the quantity of complementary color which is generated in the eye: for example, if two half-sheets of plain tinted paper, one dark green, the other of a brilliant red, are placed side by side on a gray piece of cloth, the colors will be mutually im-

proved in consequence of the green generated by the red surface adding itself to the green of the juxtaposed surface, thus increasing its intensity, the green in its turn augmenting the beauty of the red. This effect can easily be appreciated if two other pieces of paper of the same colors are placed at a short distance from the corresponding influenced ones, as below :—

Red. Red Green. Green.

It is not sufficient merely to place complementary colors side by side to produce harmony of color, since the respective intensities have a most decided influence: thus pink and light green agree, red and dark green also; but light green and dark red, pink and dark green, do not; and thus to obtain the maximum of effect and perfect harmony, the following colors must be placed side by side, taking into account their exact intensity of shade and tint.

HARMONIZING COLORS.

Primitive Colors.	Complementary Colors.		
Red,	Green,	Light Blue, Yellow, Red,	White light
Blue,	Orange,	Red, Yellow, Blue,	White light.
Yellow-orange,	Indigo,	Blue, Red, Yellow,	White light.
Greenish-yellow,	Violet,	Red, Blue, Yellow,	White light.
Black,	White,	Yellow, Blue, Red,	White light.

If attention is not paid to the arrangement of colors according to the above diagram, instead of their mutually improving each other, they will, on the contrary, lose in beauty; thus, if blue and purple are placed side by side, the blue throwing its complementary color, orange, upon the purple, will give it a faded appearance; and the blue receiving the orange yellow of the purple will assume a greenish tinge. The same may be said of yellow and red, if placed in juxtaposition. The red, by throwing its complementary color, green, on the yellow, communicates to it a greenish tinge; the yellow, by throwing its purple hue, imparts to the red a disagreeable purple appearance. The very great importance of these principles to every one who intends to display or arrange colored goods or fabrics was convincingly shown by Mr. Grace Calvert, from a great variety of embroidered silks (kindly lent by Mr. Henry Houldsworth), calicoes, and paper-hangings, which demonstrated that if these laws are neglected, not only will the labor and talent expended by the manufacturer to produce on a given piece of goods the greatest effect possible, be neutralized, but perhaps lost. It was clearly demonstrated that these effects are not only produced by highly colored surfaces, but also by those whose colors are exceedingly pale, as, for example, light greens, or light blues with buffs, and that even in gray surfaces, as pencil drawings, the contrast of tone between two shades

was distinctly visible. The contrast of tone or tint was most marked when two tints of the same color were juxtaposed, and it was therefore the interest of an artist to pay attention to this principle when employing two tints of the same scale of color. From the "mixed contrast" arises the rule that a brilliant color should never be looked at for any length of time, if its true tint or brilliancy is to be appreciated; for if a piece of red cloth is looked at for a few minutes, green, its complementary color, is generated in the eye, and adding itself to a portion of the red, produces black, which tarnishes the beauty of the red. This contrast explains, too, why the tone of a color is modified, either favorably or otherwise, according to the color which the eye has previously looked at. Favorably, when, for instance, the eye first looks to a yellow surface, and then to a purple one; and unfavorably, when it looks at a blue and then at a purple.

Mr. Grace Calvert also showed that black and white surfaces assume different hues according to the colors placed in juxtaposition with them; for example, black acquires an orange or purple tint if the colors placed beside it are blue or orange; but these effects can be overcome, in the case of these or any colors, by giving to the influenced color a tint similar to that influencing it. Thus, to prevent black becoming orange by its contact with blue, it is merely necessary that the black should be blued, and in such proportion that the amount of blue will neutralize the orange thrown on it by influence, thus producing black. As an instance, to prevent a gray design acquiring a pinkish shade through working it with green, give the gray a greenish hue, which, by neutralizing the pink, will generate white light, and thus preserve the gray.

Mr. Grace Calvert, after explaining the chromatic table of M. Chevreul, which enabled any person at a glance to ascertain what was the complementary color of any of the 13,480 colors which M. Chevreul had distinctly classed in his table, stated that it was of the highest importance to artists to be acquainted with these laws, in order to know at once the exact color, shade, and tint, which would produce the greatest effect when placed beside another color, and that they could save the great length of time which no doubt the great masters lost in ascertaining by experiment those laws, which they could now learn in a few hours by consulting M. Chevreul's work.

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*On the Relations of Gold to Light.**

Prof. Faraday read a paper, "On the Relations of Gold to Light."—This subject was brought forward on the 13th of June of last year, and in the account of that evening, at p. 310, vol. ii. of the *Proceedings of the Royal Institution*, will be found a description of some of the proofs and effects then referred to and illustrated; the following additional remarks will complete the account up to this time. The general relations of *gold leaf* to light were described in the former report. Since then, pure gold leaf has been obtained through the kindness of Mr. Smirke,

* From the Lond. Athenæum, June, 1857.

and the former observations verified. This was the more important in regard to the effect of heat in taking away the green color of the transmitted light, and destroying to a large extent the power of reflexion. The temperature of boiling oil, if continued long enough, is sufficient for this effect; but a higher temperature (far short of fusion) produces it more rapidly. Whether it is the result of a mere breaking up by retraction of a corrugated film, or an allotropic change, is uncertain. Pressure restores the green color; but it also has the like effect upon films obtained by other processes than beating. Corresponding results are produced with other metals. As before stated, *films* of gold may be obtained on a weak solution of the metal, by bringing an atmosphere containing vapors of phosphorus into contact with it. They are produced also when small particles of phosphorus are placed floating on such a solution; and then, as a film differing in thickness is formed, the concentric rings due to Newton's thin plates are produced. These films transmit light of various colors. When heated they become amethystine or ruby; and then when pressed, become green, just as heated gold leaf. This effect of pressure is characteristic of metallic gold, whether it is in leaf, or film, or dust. Gold wire, separated into very fine particles by the electric *deflagration*, produces a deposit on glass, which, being examined, either chemically or physically, proves to be pure metallic gold. This deposit transmits various colored rays: some parts are grey, others green, or amethystine, or even a bright ruby. In order to remove any possibility of a compound of gold, as an oxide, being present, the deflagrations were made upon topaz, mica, and rock crystal, as well as glass, and also in atmospheres of carbonic acid and of hydrogen. Still the results were the same, and ruby gold appeared in one case as much as in another. Being heated, all parts of the deposit became of an amethystine or ruby color; and by pressure these parts could be changed so as to transmit the green ray. The production of *fluids*, consisting of very finely divided particles of gold diffused through water, was spoken of before. These fluids may be of various colors by transmitted light from ruby to blue; the effects being produced only by diffused particles of metallic gold. If a drop of solution of phosphorus in bisulphide of carbon be put into a bottle containing a quart or more of very weak solution of gold, and the whole be agitated, the change is brought about sooner than by the process formerly described; or if a solution of phosphorus in ether be employed, very quickly indeed; so that a few hours standing completes the action. All the preparations have the same qualities as those before described. The differently colored fluids may have the colored particles partially removed by filtration; and so long as the particles are kept by the filter from aggregation, they preserve their ruby or other color unchanged, even though salt be present. If fine isinglass be soaked in water, then warmed to melt it, and one of these rich fluids be added, with agitation, a ruby jelly fluid will be obtained, which, when sufficiently concentrated and cold, supplies a tremulous jelly; and this, when dried, yields a *hard ruby gelatine*, which being soaked in water, becomes tremulous again, and by heat and more water yields a ruby fluid. The dry hard ruby jelly is perfectly analogous to the well-known ruby glass, though often finer in color; and both owe

the color to particles of metallic gold. Animal membranes may in like manner have ruby particles diffused through them, and then are perfectly analogous in their action on light to the gold ruby glass, and from the same cause. When a leaf of beaten gold is held obliquely across a ray of common light, it *polarizes* a portion of it; and the light transmitted is polarized in the same direction as that transmitted by a bundle of thin plates of glass; the effect is produced by the heated leaf as well as by the green leaf, and does not appear to be due to any condition brought on by the heating or to internal structure. When a polarized ray is employed, and the inclined leaf held across it, the ray is affected, and a part passes the analyzer, provided the gold film is inclined in a plane forming an angle of 45° with the plane of polarization. Like effects are produced by the films of gold produced from solution and phosphorus, and also by the deposited dust of gold due to the electric discharge. The same effects are produced by the other deflagrated metals so long as the dusty films are in the metallic state. As these finer preparations could be held in place only on glass or some such substance, and as glass itself had an effect, it was necessary to find a medium in which the power of the glass was nothing; and this was obtained in the bisulphide of carbon. Here the effect of gold upon the ray of light which was unaffected by the glass supporting it was rendered very manifest, not only to a single observer, but also to a large audience. The object of these investigations was to ascertain the varied powers of a substance acting upon light, when its particles were extremely divided, to the exclusion of every other change of constitution. It was hoped that some of the very important differences in the action upon the rays might in this way be referred to the relation in size or in number of the vibrations of the light and the particles of the body, and also to the distance of the latter from each other: and as many of the effects are novel in this point of view, it is hoped that they will be of service to the physical philosopher.

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*Description of an Instrument for Registering Changes of Temperature.**

By Balfour Stewart, Esq.

It lately occurred to the author that advantage might be taken of the capillary action of mercury to construct an instrument similar to a thermometer, but in which the mercury should expand from heat only in one tube, and contract from cold only in another. Accordingly a bulb was blown between two thermometric tubes of differently-sized bores, in such a manner that the tubes lay in one straight line, with the bulb between them. The bulb was then filled with mercury, and the tubes were hermetically sealed at both ends, having been first carefully deprived of air. When the instrument thus constructed was laid in a horizontal position, or nearly so, its action was precisely what the author had hoped; the mercury contracting from cold only in the narrow bore, and expanding from heat only in the wide one,—even when viewed by a microscope of considerable magnifying power.

* From the Lond., Edin., and Dub. Philos. Mag., June, 1857.

It was suggested by Mr. Welsh, Director of the Kew Observatory, that such an instrument might be used for measuring fluctuations of atmospheric temperature; and the following use afterwards occurred to the author. Were it required to exactly estimate the radiating effect of a source of heat, it might perhaps be done by placing this instrument near the source, alternately exposing it to the influence of the calorific rays proceeding from the source, and intercepting these by means of a screen. Owing to the peculiar action of the mercury alluded to, the effect of the rays would be multiplied by the number of times the screen was interposed, provided it were always retained long enough to permit the mercury to cool down. The comparison of an instrument thus acted upon with another similar instrument near it, screened entirely from the source of heat, might furnish us with a means of exactly estimating the heating effect of the source.

The author desires to express his obligation to Mr. Welsh, who, besides finding a use for the instrument, suggested the selection of tubes which appears to answer best, and whose experience was of great assistance in arranging details. He is also indebted to the Kew Committee of the British Association, who kindly examined the instrument, and authorized the construction of several by way of trial. Mr. Casella undertook the operative part in their construction, and his glass-blower, M. J. E. Griffin, took pains to discover some of the circumstances that interfere with the proper action of the instrument, and constructed those that have proved successful.

Without attempting to explain all the peculiarities of this action, it would seem that the mercury is kept in the narrow bore, and prevented from retreating into the bulb, by friction; but, when a moving force is supplied by means of a change of temperature, the motion of the mercury takes place in that direction in which it is least opposed, or most aided, by its capillary action.

As the result obtained is due to the difference between two forces, neither of which is very great, the construction of such an instrument requires care; and the author will now state what appear to be the chief points which demand attention, as derived from his own experience, and that of those who have interested themselves in the construction of the tubes; although this experience is necessarily very limited.

1st. The tubes should be quite clean and free from moisture.

2d. They should be in one straight line, and should expand symmetrically into the bulb.

3d. It seems the best arrangement, to have the narrow tube of flat bore, and not too flat; its greatest width being about equal to the diameter of the wide bore, which should be cylindrical, and neither conical nor flat.

4th. The tubes should be well deprived of air before being sealed. The instrument may be thus graduated.

If, when held vertically, the smaller tube being below, the mercury at the ordinary temperature should fill the lower tube, the bulb and part of the upper tube, the instrument may be pointed off in the same manner as an ordinary thermometer. But, if the mercury under these circumstances be not enough to fill the bulb, the best plan is perhaps to lay

the instrument horizontally in a vessel of water, side by side with a standard thermometer, and, keeping the extremity of the mercury in the one tube at a constant point, to mark off its extremity in the other tube at two or more different temperatures, as shown by the standard thermometer. The length of this tube corresponding to a degree may be then found in the usual way.

The same process may be followed with the other tube. Or, take two points in the first tube—say A and B, the distance between them being, say 50°. Set the mercury at the point A, and mark off its other extremity in the second tube. Set it now at the point B, and mark its extremity in the second tube. The distance between these two points in the second tube will be the length corresponding to 50°.

Graduate the tubes to within a short distance of the bulb, and the best plan is perhaps to number the degrees from one extremity of the instrument, beginning 0...10...20, &c., on to the mark on that side nearest the bulb. Suppose this mark is numbered 100°; then number the mark nearest the bulb on the other side also 100°, and go on upwards numbering 110°, 120°, 130°, &c., until reaching the other extremity of the instrument. In the next place ascertain the temperature of the mercury when it fills the bulb and reaches only to the nearest mark on both sides.

Let this be c°. In taking an observation, note the numbers at both extremities of the mercury, and deduct the less from the greater. To the *positive* remainder add the constant c *with its proper sign*, and the sum will give the true temperature.

Quantity of Ammonia in Dew.

M. Boussingault communicated to the Acadamy of Sciences of Paris, some interesting determinations as to the quantity of ammonia contained in dew. The dew collected on six different nights between the middle of August and the end of September, at Liebfrauenberg, contained on an average 4·92 milligrammes per litre (about 0·3 grain per gall.) This shows the nutritive effects of heavy dews. M. B. also showed how this ammonia was absorbed by porous substances. The following substances pulverized and exposed to the air for two or three days, absorbed the amounts of the gas noted.

Brick,	0·0000005.	Sand,	0·0000008.
Phosphate of lime,	0·0000008.	Wood, charcoal,	0·0000029.

Repeating his experiments in Paris, obtaining the dew artificially by condensing the moisture of the air upon a cold cylinder of metal, he obtained 10·8 mm. per litre (or ·66 gr. per gall.) of ammonia, and traces of nitric acid. This experiment shows that the atmosphere of our cities is more strongly charged with ammonia, than that of the country.

Smoke-Consuming Furnaces.

M. Dumery, whose furnaces were noticed in our *Journal* (p. 138 of this vol.) as being employed with good effect in the Museum of Natural History at Paris, states to the Acadamy of Sciences of that city, that he has ap-

plied his arrangements to a passenger locomotive, on the Paris and Meaux railway, and consumes 5 kil. of bituminous coal per square decimetre per hour, (988 lbs. per sq. yd. per hour.) It appears, therefore, from these experiments, which reach nearly the extremes of the scale of consumption of fuel, that the quantity of coal may vary in this apparatus in the ratio of 1 to 15 without the production of smoke.

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*An Improved Electric Lamp.**

Messrs. Lacassagne and Thiers, of Lyons, France, have recently been exhibiting at Paris and Lyons, an electric light of unusual brilliancy, obtained by means of a lamp, which we propose to describe. We regret having to state, before giving our description, that while M. Thiers was last exhibiting the light, about three weeks since, at Lyons, his excellent colleague, M. Lacassagne, died of a disease of the chest with which he had been long afflicted.

The objects of their invention are:—1. To regulate and to keep constant the distance between the two electrodes of electric lights, whatever may be the rapidity of the combustion of the graphite of which they consist. 2. To obtain the constant separation of the electrodes by self-acting means, operating by the action of the current which produces the light, combined with the action of a spring, or with the action of a current derived from the light current. 3. To obviate the necessity of any daily regulating of the apparatus. These results are obtained by the passage of mercury from a reservoir into a receiving cylinder placed underneath. The tendency of the mercury to rise in this cylinder lifts with little friction a piston supporting the lower electrode, which approaches the upper electrode according as the mercury of the reservoir flows down into the cylinder. The action of the electrodes approaching each other is produced by means of a valve opening and closing the tube communicating from the reservoir to the cylinder. This tube passes through one of the soft iron arms of an electro-magnet, which receives its magnetic action from the current producing the light, and which shuts the valve by its action upon an armature of soft iron, which it presses against the valve. The armature which shuts the valve by the action of the current producing the light, is attracted in an opposite direction by a spring, or by a second electro-magnet receiving magnetic action from the derived current, the intensity of which is determined by the resistance offered to it by a coil interposed for that purpose; consequently the passage of the mercury from the reservoir to the cylinder tends to establish itself under the action of the derived current, which opens the valve, and to be interrupted under the action of the principal current, which closes it; the resistance afforded to the derived current is invariable. The resistance afforded to the principal current increases by the widening of the distance or space between the two electrodes, and diminishes by their coming near to each other. If the distance between them increases, the principal current, meeting a greater resistance, diminishes in its intensity, which also diminishes the magnetic power of the electro-magnet due from the principal current which closed the valve; the inten-

* From the Lond. Mech. Mag., June, 1857.

sity of the derived current (the resistance of which is invariable) increases in the same ratio, and tends also by its action on the second electro-magnet to open the valve. If the electrodes approach each other, the contrary effect is produced ; the principal current increases by the diminution of resistance through the electrodes, while the derived current diminishes in the same proportion, and tending to close the valve to prevent the further passage of the mercury. It is then evident, that after having determined the resistance of the derived current by the length of the wire of the resisting bobbin or coil, there will be established between the two currents a kind of equilibrium, which will maintain a passage for the exact quantity of mercury that should necessarily flow from the reservoir to the electrode cylinder to lift and regulate the space between the electrodes.

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*Mozard's Safety Lamp for the use of Miners.**

The object of this lamp is to prevent the collier, whether intentionally or otherwise, from allowing the inflammable gas to come in contact with the flame. The chief feature in the invention is the impossibility of the lamp being opened whilst the light is burning—a feature which renders it worthy of very general adoption. The lamp, in appearance, is like that of Mueseler, but has a chimney in the gauze top, as used by Glover and Cail, and an improved means of raising the wick, which is flat, whereby the collier can obtain a steady bright light for many hours. The rod by which the wick is elevated is so contrived that before the bolt, for preventing the top from being screwed off, can be withdrawn, the wick must be thoroughly lowered into the wick tube, and the flame extinguished. The glass is about 3 in. in diameter and ¼-inch thick, and the supports which carry the upper part of the lamp, as in the Dumesnil, would prevent the glass from being broken, except wilfully. The double plate above the gauze, as in the Mueseler, keeps the hand-ring cool, and the chimney within the gauze effectually prevents the flames being blown through.

Daft's Improvements in Cast Iron Pipes. †

Mr. T. Barnabas Daft, of Dublin, has just filed the specification of a patent for an invention which has for its object the forming of spigot and faucet ends upon cast iron pipes, true enough to make "metal to metal" joints without turning and boring. Chills or iron moulds are made of suitable dimensions and angles, to form a spigot at one end, and a faucet at the other end, of cast iron pipes. They are placed upon the pipe pattern, and moulded therewith, and when the pattern is removed from the sand, the spigot and faucet chills are to be returned to their respective places, and the metal being poured into the mould, a pipe is c st with a spigot at one end, and a faucet at the other. This mould, if the pipe were broken to allow of them being brought together, would accurately fit "metal to metal." Consequently, were a number

* From the Lond. Mining Journal, No. 1139.

† From the Lond. Mech. Mag., Feb., 1857.

of such pipes to be made, they would fit spigot into faucet in a continuous manner, and the accuracy of this joint is found to be such that by simply wetting the surfaces to be united, and driving them home, they rust up in a few days, and form a perfectly steam tight joint, requiring several hundred pounds pressure on the inch to separate them. But generally the joints for gas and water purposes may be made by applying a luting of red lead or other suitable material, and, in some cases, tar will be found to form a sound and durable joint.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, September 17, 1857.

John C. Cresson, President, in the chair.

John Agnew, Vice President.
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary. } present.

The minutes of the last meeting were read and approved.

Donations to the Library were received from the Commissioners of Patents, London; Lieut. M. F. Maury; National Observatory, Washington, City D. C.; L. A. Huguet Latour, Esq., Montreal, Lower Canada; Hon. James H. Campbell, M. C., Pottsville, Pennsylvania; Dr. J. Aiken Meigs, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of August was read.

The Board of Managers and Standing Committees reported their minutes.

New candidates for membership in the Institute (3) were proposed, and the candidates (6) proposed at the last meeting were duly elected.

S. S. Garrigues called the attention of the members present, to a series of tabular diagrams illustrating a report, parts of which were read, on a new system of decimal weights and measures, proposed by a joint committee of the New York Chamber of Commerce, and The Geographical Statistical Society of New York, as a substitute for our present system of weights and measures, a similar report being also produced by a committee before the late session of the American Pharmaceutical Association held in this city.

Report on Imitation Marble Mantels.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, Imitation Marble Mantels manufactured by the Penrhyn Marble Company of Boston, Massachusetts,

REPORT:—That the patent is for the method of applying the colors by means of a peculiar bath, used in the place of the ordinary "size-bath," long familiar in the manufacture of marble paper. The bath now

patented, consists in a film of Dammara resin floated upon water, which may be broken up into any desired figures, by means of a rod or spatula previously dipped into the desired colors. The bath thus prepared is said to be more manageable than the ordinary one.

The article to be "marbleized" is, after being prepared with the ground color, immersed in the bath, then withdrawn, dried or baked in an oven, and then coated with a proper varnish and again heated.

The articles examined by the Committee are of slate prepared in this way—and they present resources for ornamentation, which are valuable from their comparative cheapness, and the great accuracy of the imitation of which they are capable. The slate is also stronger and less liable to injury than many of the composite marbles which are thus imitated.

Compared with the "marbleized iron," these objects are better imitations of the stone, because the iron has to be covered with a glass to give it the stone surface, and the thickness of this transparent coating shows itself in certain cases; and they are more durable, because the different expansibility by heat of the iron and glass, finally causes the latter to crack, and the iron then rapidly rusts. The new material is free from both these objections, but, on the other hand, the imitations of carved work cannot be done so cheaply as in the iron.

The Committee consider the beauty of the manufacture well deserving of the award of a First Premium from the Committee on Exhibitions.

By order of the Committee,

Philadelphia, Sept. 10th, 1857. WILLIAM HAMILTON, *Actuary.*

BIBLIOGRAPHICAL NOTICE.

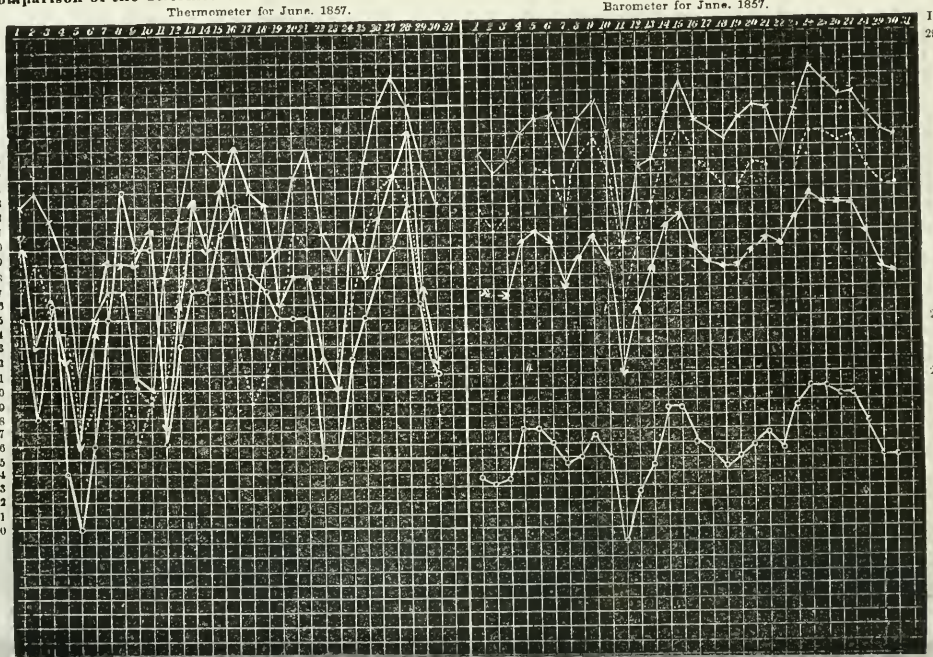
The Hand-book of Practical Receipts of every day use; a Manual for the Chemist, Druggist, Medical Practitioner, &c., &c. By THOMAS F. BRANSTON—1st American from 2d London Edition—Philadelphia: Lindsay & Blakiston, 1857.

This is a very useful little book, containing, as its title indicates, a number of valuable practical receipts, arranged alphabetically, and provided with a copious index, so that any one may be easily found, even though it should be doubtful under what title it is to be sought, and a glossary of the terms used in chemistry and medicine, which will give satisfaction to those readers who from time to time are puzzled in their studies by an antiquated or even obsolete technical term.

We wish the publishers had made it in reality what it is in form, an American edition in place of a mere reprint, for there are a great number of practical receipts of great value here, which the English profess to ignore; which might be added to the work, or even substituted for some of the matters of less interest.

We hope the publishers will think over this when a new edition is called for.

Comparison of the Thermometric and Barometric Means of Philada., Easton, Somerset, and Huntingdon Counties.



EXPLANATION.—

Those marked o—o Somerset County. Those marked +—+ Philadelphia County.

" ·—·—· Northampton " " /—\/ Huntingdon "

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PROMOTION OF THE MECHANIC ARTS

NOVEMBER, 1857.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Practical Views on the Proposed Improvement of the Ohio River. By W. MILNOR ROBERTS, Civil Engineer.

(Continued from page 231.)

7. *The seventh objection is*, "That locks and dams will set a limit to the amount of freight which can be transported on the river."

In examining this we would call to recollection the fact that during about one-sixth of the time there will be a free, unobstructed navigation over the dams, both for ascending and descending craft; and that during half the time there will be a safe descending navigation over the chutes of the dams: it is believed that rafts may run them whenever they can run the Allegheny River, and that few *rafts* will pass through the locks. Much lumber will probably pass the locks in *barges* as a matter of choice. The coal business, as already suggested, will, from considerations of economy, be carried on largely through the locks in barges, towed by regular steam tugs; the barges will be arranged in fleets. The tug can take nine or more barges of 250 tons each, through a lock in 15 minutes. If we allow but one such fleet to pass per hour, it will give 54,000 tons per day, or an aggregate of eighteen millions three hundred and sixty thousand tons per year of 340 days! A quantity greater than is now shipped in the entire Union, on all the rivers, canals, and railroads. And yet but one-fourth the capacity of one of the double locks would be occupied. For the remaining three-fourths let us assume that four steamers may pass, each carrying 500 tons, or 2000 tons per hour, or 48,000 tons per day, or sixteen millions

three hundred and twenty thousand tons per year. Making an aggregate of thirty-four millions six hundred and eighty thousand tons; without counting any tonnage that would pass over the dams. And what sort of a "limit" is this? The Charleston and Memphis, Baltimore and Ohio, Pittsburgh and Connelsville, Pennsylvania Central, Allegheny Valley, New York and Erie, New York Central, and all the great Canada railroads united could not accommodate the half of such an enormous trade. With double locks fifty per cent. more could be passed. The locks are not made with chambers so large—350 by 65 feet, merely capacious enough for a given or expected tonnage, but for the accommodation of the larger size of Mississippi steamers, so that they need not necessarily break bulk between New Orleans and the head of the Ohio. Practically, this objection on the score of limit of capacity of the locks has not the least weight; for should the business ever increase to the capacity of the double locks, it could certainly afford treble or quadruple locks, if required.

8. *The eighth objection is* expressed thus: "What, I ask, would be the condition of things if one of the fifty dams, which it is so lightly proposed to construct on the Ohio, should be washed away, or undermined, and the navigation there suspended for four months?" This may be taken as stating that the undermining or washing away of a dam would suspend the navigation four months—or some long period of time. The writer will take direct issue on this point, and affirm from his experience, applied to such a system on the Ohio River, that such result *cannot ensue.* There is very little danger that dams properly built, will actually wash away. But suppose a dam did wash away; it would at least leave the river along that part as good as it was in its natural condition. Yes, it would leave it rather better, on account of the back water from the next dam below. It would require the washing away of two consecutive dams to bring the river along that part back to its natural condition.

A dam may be undermined. Suppose it to be so, so that for several hundred feet of its length, or its whole length, it should sink two or three feet below the regular height, what would follow, practically? The cause of such injury would of course be a flood. So long as the flood continued the *navigation* would not be *injuriously* affected (by the sinking of the dam) either through the locks or over the dam. The navigation would not be affected until the flood had subsided, and the water had fallen so low as to leave a scant depth at the entrance of the next lock above. But mark, in the very nature of things, this depth could never be *less* than it would be in the natural river in a similar stage of water.

By the time the water in the Ohio had fallen so low as to afford insufficient depth at the lock above, the superintendent would have control of the dam below so as to keep up the pool to a proper height to maintain the navigation until the permanent repairs of the dam could be made. And if an entire dam and the locks at the same were swept away, what would be the consequence? The objection raised is intended to convey the impression that the navigation would *cease*, that all movement of vessels and craft of every kind would be stopped for

months. We allege, positively, that it would not stop for one moment. The navigation along that particular portion of the river would continue as good as it was before the erection of the slackwater, and better. The peculiar advantage of the Ohio River slackwater, on account of its abundant supply of water, will be, that a serious injury of a portion of the works will not destroy the navigation. In almost any possible event, the repairing force on the improvement could, within 48 hours, make it passable for vessels, should an accident temporarily render it otherwise. Injury, so as to stop the working of both locks simultaneously—*at a time when steamers could not pass over the dam*—could alone stop the navigation. When the water was not high, such an event would be exceedingly improbable. The locks being all the same size and lift, the gates and all the parts of one would fit another. Ordinary prudence would dictate the keeping of a few finished gates and parts of gates, for such contingencies. In case all the gates of both locks should be carried away, an experienced superintendent could have one set replaced before the steamers should cease running over the dams; or, in case the accident happened at a low water period, within 48 hours after its occurrence. An objection to the Ohio slackwater on the score of liability to injury—*so far as the navigation* of the river is involved—has much less weight than a similar objection to any canal in the country, where a serious break would absolutely stop the navigation.

It is an objection, that any work, merely human, is liable to derangement; but to press this too far against proposed public works, is neither wise nor politic. With equal propriety we may figure each of the proposed artificial reservoirs, and the great dams, as tumbling to destruction, bringing ruin in their train. The writer presents no such fear as an objection to them, although it must be conceded by every engineer that dams 50 or 100 feet high require more care, precaution, and extra cost to guard against accidents, on account of the largely increased pressure from the additional head of water. If this eighth objection is to be regarded as of much consequence, it must follow, that the proposed high dams on the Allegheny must be discarded, leaving the artificial reservoir system dependent entirely upon a series of comparatively small reservoirs.

The dams on the Monongahela were tolerably well built; they can be better built on the Ohio. The experience acquired on the former and elsewhere, can be advantageously applied in making a more perfect improvement; and with double locks throughout, there should be much less trouble and detention on the Ohio.

9. *The ninth objection is*, "That the dams which it is proposed to construct on the Ohio River, will convert the channel of that river into fifty stagnant and pestilential ponds, endangering the healthfulness and diminishing the population of its valley."

This objection has been gravely set forth, without any reference, however, to evidence showing where, in any analogous case, such an effect had been produced. It appears to be purely speculative. As a positive and complete refutation of this mere assertion, we may point to the Lehigh, the Schuylkill, the Susquehanna, the Juniata, the Kiskiminetas, the Beaver, &c., &c.; the valleys of which streams, have become *more*

salubrious, more free from bilious epidemics, than they were prior to the erection of the dams. On the Monongahela, the health of the valley has been improved, and the population and business have been *immensely increased* in consequence of the slackwater. Mr. Ellet, in his original paper published by the Smithsonian Institute, took the correct, common sense view of this question when he said, "But the salubrity of rivers, when no longer subject to become dry, and have their sands and vegetable deposit exposed to the summer's sun, must necessarily be increased; for the same experience which teaches that large masses of fresh water, existing as lakes, are salubrious, also teaches that shallow stagnant pools, such as are found in the place of an exhausted river, are deleterious to health." This latter point of course had reference to the river in its natural state during periods of great drought.

The quantity of water that will be contained in the pools of the Ohio slackwater will be very great, and the healthfulness of the valley is much more likely to be improved than injured thereby. The ninth objection, on the score of health, appears to have less ground of support than any which has yet been named.

10. *The tenth objection is*, "That the delays at the locks will be greater than the running time now required to make the trip; and consequently the time now required for every ordinary voyage will be *more than doubled* by the detention at the dams."

This is a very strong statement, but fortunately it comes as a mere opinion. No attempt has been made to fortify it by facts, or from practical reasoning. *Facts*, go to prove the direct contrary, as will be shown. Facts, and legitimate reasoning, will both prove the reverse of the proposition so boldly put forth as an *objection* to locks and dams. We will first refer to a few facts furnished by a gentleman who, although not yet in favor of locks and dams for the Ohio River, is very familiar with the system and its operation on the Monongahela—Captain E. Bennett, who has been running steamers on that river almost ever since the completion of the improvement.—He says, "the time of running the 55 *miles*, including the passing of the 4 locks, varies from 6 hours down to 5 hours and 15 minutes by different boats. Generally it takes as long to go down as to go up. We count the time it takes, including all stoppages for freight and passengers, 8 hours up and 8 hours down. The average time required to pass each lock is from 7 to 10 minutes, but it can be done much quicker if required. A boat has been passed through No. 4 in a good stage of water in 2 minutes 20 seconds. We can land and put out a passenger and get under way again in from 2 to 3 minutes. Before the completion of the slackwater I do not recollect coming up (from Pittsburgh to Brownsville) in less than 12 hours, and frequently from 20 to 24." * * "We frequently make the trip, when the river is frozen to the thickness of three inches." * * "I think the ice does not form so quick in the pools in the first freeze as it did before the dams were built, owing to the greater body of water to be brought to the freezing temperature.

"I cannot say that the boats have been stopped by low water more than the summers of 1854 and 1856. In 1854 our boats were laid by 82 days, and a good part of that time there was no navigation for any

steamboat of lighter draft (our boat draws 3 feet light). Our locks and dams have not caused much detention by being out of repair. We are occasionally detained for a short time by something getting behind or before the gates so as to prevent their opening or closing." We may hereafter have occasion to refer more particularly to the opinion (expressed by Captain Bennett in his letter) against the introduction of locks and dams on the Ohio. At present we merely wish to investigate the objection raised on the score of "*delays*."

The average length of the pools on the Ohio, with 50 dams between Pittsburgh and Cairo, will be 20 miles. A steamer in a round trip would pass 100 locks. Allowing the loss of time in passing each lock to be 12 minutes (which experience proves to be a very liberal allowance), the entire lockage time would be 20 hours—10 hours down and 10 hours up. A part of this should not be regarded as lost time, as many of the locks will be established as regular "*landings*," for passengers and light freight, which will be transferred during the passage through the locks. But for the present, let it all go against the slackwater system as lost time. During a considerable portion of each year, that is, whenever there is not more than a foot or eighteen inches of water flowing over the wiers of the dams, the current in the pools will be very slight, so that the difference in the running rates of ascending and descending steamers will not be perhaps more than a mile an hour. And during this period the current is so gentle that steamers will land on their downward passage without losing time by rounding to. Assuming that there would be at least one intermediate landing, as frequently as every alternate pool, or once in 40 miles, it would give 25 descending landings per trip. Putting the loss of time caused by *rounding to* at 6 minutes, it gives 2½ hours saved in consequence of slackwater.

In he most favorable stage of the natural river, steamers on an average may run down stream about 14 miles an hour, and up stream about 8 miles an hour. The same steamers will *gain* much more in ascending through the pools than they will *lose* in descending the same. This is what experience and theory both establish. The difference even under the most favorable circumstances of the natural river, is at least worth noting; but as soon as the river falls to a 4 or 3 feet stage, this difference largely increases, in consequence of the delay in ascending the ripples, and in consequence of the delay in *descending* the same; for they dare not then run at full speed, to say nothing of the delays caused by grounding. The number of days when the water was below a 4 feet stage during the eleven years from 1838 to 1848 inclusive, was 1185, being an average of 108 days per annum. In one year, 1845, it was 139 days.

The number of days when the water was between 4 and 12 feet stage, was 2244, being an average of 187 days per annum, though in 1841 there were but 151 days. During the same period of eleven years, the average number of days when the stage of water was between 5 and 12 feet was 170, and between 6 and 12 feet, 146 days.

Navigation on the Ohio River may be roundly divided thus: 3½ months below 4 feet; 2½ months above 12 feet; and 6 months between 4 and 12 feet.

There will be 3½ months of the year when the slackwater will have

greatly the advantage in the *time* of a trip; six months when the time of a trip would be almost equal; and 2½ months when they would be just equal, that is, when the steamers would run over the dams. But we have another fact to consider, namely, that for 2, 3, 4, or even 5 months of some years, large steamers *cannot now run at all;* and also times when the very smallest class steamers, carrying at prices more than double or treble high water rates, cannot run.

It is therefore unfair and unreasonable, in comparing slackwater with the natural river, to set down the time of passing the locks against the former without bringing into juxtaposition the other facts, which go to show that that delay is fully compensated for. If we state the actual daily performance on the Monongahela, where the dams are one-fourth more frequent or closer together than they will be on the Ohio, we shall find that in a round trip they make better speed than is made on an average on the Ohio in the natural river. This is an actual fact, which cannot be overlooked. What then becomes of the assertion, "That the delays at the locks will be greater than the running time now required to make the trip?" It was obviously made at a venture, without much calculation or investigation, and the statement is contrary to all experience. It will be found on the Ohio, that although the downward passage in a good stage of water is made quicker on the natural river, that the upward passage will always be much quicker on the slackwater. It is easy to prove that this tenth objection, as stated, is a random suggestion: thus, the running time on an average, now required to make the round trip of 2000 miles, is, say, 80 hours down, and 125 hours up, equal to 205 hours: this gives a little more than 2 hours to each lock. According to this same sweeping mode of calculation, the *detention* alone at the Monongahela locks, ought to be over 16 hours; whereas, the steamers actually run the 110 miles, pass the locks, make all their landings, and complete the round trip in less than 16 hours! And yet these and similar assertions, must be gravely met, and their futility exposed, or they will be reiterated again and again.

11. *The eleventh objection is*, that "If dams are placed across the channel of the Ohio, all the trade of the river for 50 weeks of the year, will be forced through the locks." There are different ways of stating a question. This is one way. It admits, however, that there will be a *navigation* for 50 weeks of the year; the two weeks, it is presumed, being cut off on account of ice. Whereas, in the natural river, we have often no navigation. Now Mr. Ellet's calculations, and the records show, that for ten weeks there is a natural flow of over 12 feet water on the Wheeling bar, during which period all vessels can pass freely over the dams, without using the locks, if they should prefer it; and vessels of moderate draft may pass over them on many other days. As to being "forced" to use the locks, how gladly will business men avail themselves of the opportunity, when, without them, for so much of every season, they are now deprived of all navigation.

It is true enough, that even a perfect lock and dam navigation may not be so good as a perennial river with a steady six feet flow of water. Unfortunately, the Ohio River is very different from this. What value would a great railroad have, if it could only be used one half the year,

at irregular, uncertain periods: and a part of that time, with only half trains, &c., &c.? On the other hand, could the Ohio River be made constantly reliable, with a natural flow, its value would be almost incalculable. There may be other minor objections to a slackwater navigation on the Ohio River; but scarcely any that can be worthy of grave refutation. Objections may be raised against any proposed public improvement; but in regard to slackwater navigation, it should be kept in mind that it is no longer an experiment; experience has sanctioned and established it as highly advantageous in certain cases. The real question is, are the solid objections to its introduction on the Ohio so great, that it cannot be made practically advantageous on that stream?

In the Appendix to this paper will be found some information, derived from practical sources, which the writer thinks will aid in arriving at correct conclusions upon some of the leading points belonging to this discussion.

We may recapitulate the chief points which the writer regards as tolerably well established; and first, in connexion with the plan of

Artificial Reservoirs.

That the annual flow of water in the Ohio at Wheeling if equalized is sufficient to afford a depth of 6 feet in the driest season.

That if "expense, damages, and health" be disregarded, it may be possible to construct reservoirs enough to effect it. That the estimate of the cost published by Mr. Ellet, is obviously altogether too low; and that even the greatly increased estimate of Mr. Morris, is quite short of the probable requirement.

That such large reservoirs as those described by Mr. Morris, cannot be advantageously located on the tributaries, and that sites containing all the elements designated, do not exist, either on the tributaries, or on the main streams; and that no where, above Pittsburgh, will six dams of 100 feet height contain half the quantity he has assumed.

That the advocates for artificial reservoirs, have made no allowance for evaporation between the reservoirs and Pittsburgh; although some of the reservoirs must be several hundred miles distant; nor have they made any allowance for the fact that on account of the greater declivity of the Ohio above Wheeling, a greater quantity of water will be required to maintain the same given depth.

That Mr. Ellet's estimate that 12 inches per annum from rains, &c., may be utilized, is safer than Mr. Morris's estimate of 18 inches; and that there are seasons, as shown by the flow at Wheeling, when even 12 inches would be an over estimate.

That the records at Wheeling, and the calculations of Mr. Ellet, prove that his proposed "regulating reservoirs" would be of no practical use in controlling great floods. That the two things—keeping up a regular navigation from reservoirs, and controlling floods—are incompatible; one demanding that the reservoirs shall be allowed to fill to supply the river in droughts, the other that they should be as nearly empty as possible, to be useful in holding back floods. The records show that in the great majority of floods, for eleven consecutive years, such reservoirs would have been full before the great floods came.

That to regulate the flow of the Ohio River to a uniform or to "nearly a uniform flow," would demand a vast array of reservoirs both on the main streams and on the tributaries; and that instead of being a "comparatively easy task," only requiring an expenditure "equal to a three years' cruise of three ships of the line," the cost would be enormous: and that such control of the Ohio could only be attained by the total destruction of interests greater than those it could by any possibility benefit; and that the same proposition, as applied to the Mississippi and Missouri Rivers, should fairly be regarded in an engineering sense, as *impracticable.*

And in all the foregoing calculations, the drainage of the entire area of territory above Wheeling, has been included; whereas, the actual drainage of the two rivers, Allegheny and Monongahela, is but a trifle over two-thirds of that area: almost one-third of the whole being derived from streams entering the Ohio River below Pittsburgh. The area drained by the Allegheny is nearly two and a half times that of the Monongahela.

Secondly. In regard to the plan of low open dams without locks.

That this is only to be considered as a modification of the plan of artificial reservoirs, and as a means of saving water; and that although such a system might be available on the Ohio where the declivity gradually decreases from 12 inches per mile to 3 inches per mile, it would not be applicable on rivers of greater descent.

That if the artificial reservoir system be adopted, then the plan of low open dams should be more carefully investigated on account of the promise it seems to hold out of saving so much water.

Thirdly. In regard to the proposed

System of Locks and Dams.

It seems to be demonstrated, that there is at all times, even in the driest season known, an ample supply of water for slackwater purposes without resorting to artificial reservoirs: and that this is also proved by records and measurements which are undisputed! And that for the greater portion of every year, there will be a very large daily surplus, which may be made available for hydraulic purposes.

That by means of chutes in the dams, the descending navigation may be kept good for rafts and arks at those periods when the Allegheny River is in a favorable stage for the passage of the same craft.

That the largest steamers and also steam tugs towing numbers of coal barges, may pass the locks; and that the amount of trade which can be conveniently accommodated with a system of double locks, is so enormous, that it presents no real practical limit.

That the probable cost of a slackwater improvement of the Ohio, can be obtained in advance, approximately, with greater accuracy than in the case of railroads or canals, generally: and that it is not likely to exceed $12,000,000; and that the annual cost of repairs will not be likely to exceed $110,000 per annum.

That a rate of tolls which will scarcely be felt, will handsomely sustain the works.

That during nearly two months of each year, there will be a safe

ascending and descending navigation over every part of the dams, when it will be optional for vessels to use the locks or not; that during three months of the year, or more, there will be a safe descending navigation through the chutes for rafts, &c.

That twelve feet rise in the natural river will create a depth of about five feet on the dams; 18 feet natural rise, about 9 feet; 24 feet natural rise, about 13 feet; 30 feet natural rise, about 18 feet; 36 feet natural rise, about 23 feet; 42 feet natural rise, about 29 feet; and 48 feet natural rise, about 35 feet on the dams. Thus, with the small rise of 12 feet, the dams will augment the height of the water above its natural elevation, more than six feet, while in the great flood of 48 feet, the dams would add only about one foot to the rise due to the natural river.

That always, before the locks will be submerged, the dams will be safely boatable, both for ascending and descending craft.

That injury to a dam can only improve the navigation *over the dam;* that it does not necessarily injure the navigation through the locks. A dam may be seriously damaged without interfering in the least with the navigation through the locks. Dams are not injured during low water; and not until the return of low water, could an injury to a dam affect the navigation at the locks: and then it is easy to keep up, temporarily, a sufficient height of water, until the injury may be repaired.

That nothing connected with a river lock, if properly constructed, except the gates, can be fairly regarded as liable to serious injury. And the locks being all alike, a few gates kept on hand, would obviate any great delay, even in the not very probable event of the destruction of the gates of both locks simultaneously. The loss of all the gates of but one of the locks, would cause no delay. Besides, such serious injury is only likely to happen during high water, when vessels would have free passage over the dams: giving time to perfect the preparations for the thorough repair of the damage.

That on a good slackwater navigation, taking the year round, first class steamers will make the trip between Pittsburgh and Cincinnati, or Cairo, &c., in *less time*, and at *less expense*, including tolls, than they can now; and that every steamer can make many more trips each year on the slackwater, than she ever could before. With the facility, certainty, and regularity secured by the slackwater, the aggregate annual trade will be immensely increased, requiring even more boats; each one more profitably employed than now.

That as a consequence of the increased safety and regularity, the rates of insurance may be greatly diminished. Collisions will be less likely to occur.

That the old fashion of conducting the coal business, between the Upper and Lower Ohio, and the Mississippi Valley, will, from choice, and from economical motives, be entirely abandoned. Barges will be substituted for the *frail arks*, which now not only never return, but in too many instances never reach their destination. Consequent upon this change, the coal business will rapidly and largely increase, beyond the calculations of the most sanguine—to the advantage of the consumer as well as the producer; regulating the price to a nearly uniform rate throughout the season, and incidentally giving the coal operators

more complete control over their mining hands: at the same time it will be better for the miners.

That the improved slackwater navigation will soon induce a considerable change in the mode of carrying on the *lumber trade.* Large amounts of lumber, logs, &c., will be taken from the water in the vicinity of Pittsburgh, to be seasoned and partially worked, and afterwards shipped on *barges* to the various points in the great Mississippi Valley; where the demand, to the third generation, must be an annually increasing one.

That the locks, in time, will all become passenger landings, as well as points for light freight, and many of them for general business; thus reducing to some extent, the number of other transient landings.

That it may be safely assumed that after the completion of a perfect slackwater navigation, the *average* rate of freights on the Ohio, and consequently between the Ohio and all points in the great valley along the rivers, will be *materially reduced.*

General Conclusions.

1. The writer has attempted to show to others, what he believes, that there are great practical difficulties in the way of so extensive a system of artificial reservoirs as would be necessary to supply the natural bed of the Ohio River with six feet depth of water all the year; nor does he assume by any means to have exhausted this branch of the subject. But if it can be shown that the reservoir system, *for such a purpose*, is really practicable, even at a cost of $20,000,000, the *cost* should not prevent its adoption.

2. The Ohio River has *four times* as much descent per mile between Pittsburgh and Wheeling, as it has near its lower portion below Evansville; it also becomes gradually wider, though not in proportion to the diminished declivity. From this, two things would seem to follow: first, that on the reservoir plan, it will require *more* artificial supply of water at the upper end than would be needed at the lower end, especially if, as we think, the lower portion of the river is better fed naturally from the side tributaries; and second, that on the slackwater plan it will require *less* water at the upper end than below, for two reasons—having shorter dams, causing less leakage—and narrower pools, making less evaporation towards the upper portion of the river.

3. After a complete investigation of the subject, it may be found, that the plan for keeping up the flow of the river in its natural state, may be regarded as impracticable; in that event it does not follow, that the plan of low open dams, requiring only *one-third of the water*, should also be deemed impracticable; the question might then stand between the plan of low open dams and the slackwater plan. If the water supply for the open dams should be demonstrated as fairly practicable at a reasonable cost, judgment might still be given in favor of the low dams without locks, notwithstanding certain objections.

4. It is obvious, that the necessity for a radical improvement of the Ohio, is becoming greater every year, with the increase of railroad facilities between the Ohio Valley and the Atlantic coast, and with the very general and truly wonderful annual increase of population and trade of the great Mississippi Valley.

5. That even at present, the aggregate annual losses to the cities, towns, and contiguous country directly interested, and mainly dependent upon the Ohio River as an avenue of commerce, added to the loss to steamboat owners, coal operators, coal dealers, &c., from the failure of a single season's navigation, such as occurred in 1856, would amount to a very large proportion of the gross cost of permanently improving the river. No fact seems better settled than this.

6. Whilst it is no easy task to determine how the river can be best improved, it is desirable that the subject should be investigated and reported upon in such a manner as *to command the respect and confidence of the country.* Experience, every where, teaches the danger of *merely* legislative decisions of such questions, though it is the legitimate province of Congress to provide for their thorough *investigation* and determination. Congress, at its last session, acted upon this subject; but owing to various causes, the bill which passed one branch, was not reached in the other, and failed to become a law. It is to be hoped that at the coming session a proper law will be enacted, providing for such an enlightened commission as will be able to settle the question finally.

———o———

Although the quantity of water required to maintain a steady flow of any given depth through open sluices of regular width, may be calculated with considerable accuracy, yet in the case of an open river of an uneven section, irregular in width and declivity, it cannot be expected that any more than a rough approximation can be attained: more uncertainty must necessarily attend the measurements, and consequently, the results founded thereon. Whether this should operate in favor of, or against the proposed plan of supplying the Ohio River by artificial reservoirs, is a question which the writer leaves to the determination of others: all who have read Mr. Ellet's papers can judge for themselves. His calculations are based on measurements made at Wheeling, where the declivity of the river is considerably less than at a number of points above Wheeling. It seems fair to infer, that a quantity of water that would give six feet depth at Wheeling, would not give so great a depth at certain points higher up.

Upon a critical examination, it may be found that much more water would be necessary, than we have hitherto assumed in the course of this investigation, to secure six feet depth between Pittsburgh and Wheeling.

Again, respecting the drainage, Mr. Ellet remarks in regard to the drainage of 1844, which was 11·32 inches, according to his approximate estimate, that it is "almost precisely the amount ordinarily assumed by engineers as the supply that may be relied on for canal feeders, *but by no means that which ought to be uniformly anticipated.* There is, in fact, scarcely an approach to uniformity in the annual discharge of streams in this climate." Ample exemplification of this, as a general fact, may be seen on an examination of rain tables in almost any part of the world, where the rainfall has been registered.

Early European Views of Plans of Reservoirs for Supplying Rivers.

In a work written by Mr. Thomas Telford, about the year 1800, he discussed the question of the improvement of the navigation of the River

Severn. It is thus mentioned in Rees' Cyclopædia. "Mr. Thomas Telford has (page 288,) proposed another method of improving the Severn River, by collecting "the flood waters into reservoirs, the principal ones to be formed in the hills of Montgomeryshire, and the inferior ones, in such convenient places as might be found in the dingles and along the river. By this means, the impetuosity of the floods might be greatly lessened, and a sufficient quantity of water preserved to regulate the navigation in dry seasons, &c. This, it is thought, might even prove the simplest and least expensive mode of regulating *navigable rivers*, especially such as are immediately on the borders of hilly countries."

Mr. William Jessup, on another occasion, says, "rivers may be rendered nearly uniform throughout the year by reservoirs."

Mr. Rennie, an engineer of the first reputation in his profession, remarked: "After what has been said respecting the excess of flood water in the River Roch above the ordinary supply, the *idea of correcting the floods of the Severn* by reservoirs, must appear to be ridiculous."

The Severn, although a considerable stream in England, is greatly inferior in size, extent of drainage, height of floods, &c., to the Ohio. In its low stages, however, it assimilates very nearly to the low stages of the Ohio.

The whole length of the Severn, up to Welshpool, is 155 miles, while the Ohio, up to Pittsburgh, is 1000 miles. The highest floods in the Severn were about 16 feet—the average height of floods about 7 feet: while the highest floods in the Ohio are from 40 to 60 feet, and the average height of floods is over 20 feet.

There may be some rivers in England, and some in the United States, which would admit of material correction, or control, by means of reservoirs, but does it hence follow, that it is practicable to govern or control all rivers? The entire territory of Great Britain is much less than the area of country drained by the Ohio River. The drainage of the Ohio, above Wheeling, is about half the area of all England. When Mr. Ellet published his "Physical Geography of the Mississippi Valley," in 1849, he was not probably aware that the same plan for improving and controlling rivers, had been formally proposed, nearly sixty years ago in England, as above quoted.

There is some coincidence between the calculated drainage of the Thames River, in England, and the Ohio River above Wheeling, which may be worth a passing glance: thus, in England, with 6000 square miles of drainage, the average annual flow from the Thames, is assumed by Dr. Halley, at 166,624,128,000 cubic feet; the average annual flow as deduced by Mr. Ellet for the Ohio River drainage above Wheeling, (25,000 square miles,) is 835,000,000,000 cubic feet; one showing 27,770,688 and the other 33,400,000 cubic feet per square mile.

According to Mr. Ellet's calculations, to have regulated the supply of the Ohio in 1848, it would have required reservoirs capable of containing fifty per cent. more than *the entire flow of the Thames for a year.* But it has been shown in the text, that uniformity could not have been secured even with reservoirs of this great capacity.

APPENDIX A.—FALL OF RAIN IN VARIOUS PLACES, DRAINAGE, &c.

"The mean quantity of rain falling annually at 147 places, situated between north latitude 11°, and 60°, deduced from tables kept at those places, is 34·7 inches." (From a paper published by M. Cotte in the (*Journal de Physique*, for Oct., 1791.)

"The mean annual quantity of rain is greatest at the equator, and decreases gradually as we approach the poles, thus at

Granada, Antilles,	12°	North Latitude	it is	126	inches.
Cape François, St. Domingo,	19° 46′	"	"	120	"
Calcutta,	22° 23′	"	"	81	"
Rome,	41° 54′	"	"	39	"
England,	33°	"	"	32	"
Petersburgh,	59° 16′	"	"	16	"

"On the contrary, the number of rainy days is smallest at the equator, and increases in proportion to the distance from it.

"From north latitude 12° to 43°, the mean number of rainy days is 78, from 43° to 46° the mean number is 103; from 46° to 50° it is 134." * * * "And more rain falls in mountainous countries than on plains."

We find in Gregory's Dictionary of Arts and Sciences, some interesting information compiled from the transactions of different learned societies, giving results shown by rain gauges kept at different places in England, through a series of years, varying from one to twenty-one years.

The average annual fall in 23 places, registered as *maritime* counties, was 38½ inches; while, in 7 places referred to as *inland* counties, the average annual fall was 24 inches.

Among the maritime counties, the highest recorded was at Keswich, in Cumberland County, 67·5, average of 7 years; the lowest at Carlisle *in the same county*, 20·2 inches one year.

At Liverpool, 18 years average 34·4 inches.

At Manchester, 9 years average 33·0 inches.

Among the inland counties, the highest recorded average was at Chatsworth, 15 years 24·8 ins., and the lowest at South Lambeth, 9 years 22·7 ins.

The mean annual average in London, 7 years, was 23 inches.

From the foregoing, it will be observed, that while in the maritime counties, the mean average in different places *varied* to the extent of 47·3 inches, the variation in the inland counties was but 2·1 inches; a remarkable difference, and the average mean annual fall in the maritime counties was 60 per cent. greater than in the inland counties. Thus, in a comparatively limited area, not exceeding that of one of our larger states, in thirty different localities, these great variations occur; some portions of the territory receiving more than three times the rainfall of other portions, even in the maritime counties; while in the inland counties there is a singular uniformity, and very much less rain. We infer that in making calculations for reservoirs in England, it would be necessary to attend critically to the records of a rain-gauge, or the measurements of the streams flowing from the particular regions in question.

In regard to a great number of local reservoirs to be established at widely separated points along the head waters of the Ohio above Wheeling, embracing an area nearly half as large as England, some attention would seem to be necessary to determine the local characteristics of each

separate region. We know from records kept by the United States officers at numerous points, that the variations in our country are even greater than they are in the European tables just quoted; running from 3 inches to 76 inches per annum; occupying, however, a much more extensive area.

On the Pacific coast, within 600 miles of each other, one post, Fort Orford, has the maximum 68·52 inches, and the other, Fort Yuma, the minimum 3·24 inches of the rainfall recorded.

The following Table is extracted from the "Army Meteorological Register," and presents the results at various points for 33 years, from 1822 to the close of 1854. It is only a portion of a larger table.

	Latitude.	Longitude.	Elevation above the sea in feet.	Average annual fall of rain in inches.
Fort Kent, Maine, .	47°15′	68°35′	575	36·46
Fort Preble, " . .	43 39	70 20	20	45·25
Fort Constitution, N. H., .	43 04	70 49	40	35·57
Fort Independence, Mass.,	41 21	71 09	50	35·30
Fort Adams, R. I., .	41 29	71 20	40	52·46
Fort Hamilton, N. Y. Harbor,	40 37	74 02	25	43·65
Plattsburgh Barracks, N. Y.,	44 41	73 25	186	33·39
Fort Ontario, N. Y., .	43 20	76 40	250	30·88
Fort Niagara, " . .	43 18	79 08	250	31·77
Allegheny Arsenal, Penna.,	40 32	80 02	704	34·96
Carlisle Barracks, " .	40 12	77 14	500	34·01
Fort Mifflin, "	39 53	75 13	20	45·27
Washington, D. C., .	38 53	77 02	70	41·20
Fort Monroe, Virginia, .	37 00	76 18	8	50·89
Augusta Arsenal, Ga., .	33 28	81 53	600	23·00
Fort Pierce, East Fla., .	27 30	80 20	30	62·98
Fort Pike, La., . .	30 10	89 38	10	71·92
New Orleans, La., .	29 57	90	10	50·90
Fort Smith, Ark., . .	35 23	94 29	460	42·10
Fort Gibson, Ind. Ter., .	34 47	95 10	560	36·46
Jefferson Barracks, Mo.,	38 28	90 15	472	37·83
St. Louis Arsenal, " .	38 40	90 05	450	41·95
Detroit, Michigan, .	42 20	82 58	580	30·07
Fort Mackenac, " . .	45 51	84 33	728	23·87
Fort Winnebago, Wis., .	44 30	88 05	620	34·65
Fort Des Moines, Iowa, .	41 32	93 38	780	26·56
Fort Atkinson, " .	43	92	700	39·74
Fort Snelling, Min., .	44 53	93 10	820	25·43
Fort Leavenworth, Kan.,	39 21	94 44	896	30·29
Fort Kearney, Nebraska, .	40 38	98 57	2360	27·98
Fort Laramie, " .	42 12	104 47	4519	19·98
Fort Worth, Texas, .	32 40	97 25	1100	40·86
Phantom Hill, " .	32 30	99 45	2300	17·22
Fort Croghan, " . .	30 40	98 31	1000	36·56
Fort McIntosh, " .	27 31	99 21	400	18·66
Fort Webster, New Mex., .	32 48	108 04	6350	8·79
Fort Conrad, " .	33 34	107 09	4576	6·76
Albuquerque, " .	35 06	106 38	5032	9·42
Fort Yuma, California, .	32 43	114 36	120	3·24
Monterey, " .	36 36	121 52	140	12·20
Fort Humboldt, " .	40 46	124 09	50	16·77
Fort Orford, " .	42 44	124 29	50	68·52
Fort Dallas, Oregon, .	45 36	120 55	350	14·32
Fort Steilacoom, Wash. Ter.,	47 10	122 25	300	51·75

The great variations exhibited between points but a few miles apart, prove the same thing shown by the records of the flow of water at Wheeling; that the rainfall is entirely irregular, and that the results obtained from the most careful observations at any given locality, cannot be assigned to any other point. Hence, in the opinion of the writer, an extended system of rain gauge observations among the head waters of the Ohio, would not be likely to present any more reliable data than the records of the actual flow at Wheeling already shown, except for special localities. Indeed, this would seem to present a better approximation for general calculations, considering the object in view, than the records from rain gauges.

Mr. Ellet makes the annual average flow at Wheeling equivalent to a depth of 14·778 inches over the whole area of country drained. But one year, 1845, gave but 9·83 inches. In 1844, it was only 11·52 inches. Thus two consecutive years gave less than 12 inches.

In calculations designed to form the basis of a system dependent *entirely* upon the annual downfall of water, would it not be prudential to assume the *lowest* annual result, as an event to be anticipated? Thus, in placing a reservoir, we should allow sufficient area of territory above the dam, to barely fill it once a year with the minimum of 9·83 inches, in preference to assuming the larger result, 18 inches: otherwise, we may expend money uselessly. In the absence of long continued observation of the actual fall in any given locality, this would appear to be the only safe guide.

In regard to the great reservoirs proposed on the main navigable rivers, it is different, because we know beforehand, that all of them combined, will not contain the drainage of the driest year.

There is another point connected with the failure of water and storing up in reservoirs, not adverted to by the advocates of the artificial reservoir system. Having theoretically set apart 3600 square miles (out of about 25,000 square miles,) which represents the artificial source of supply needed to maintain a six feet stage in the river for a given number of days, it must follow, that it will not be quite sufficient in practice. If this additional supply originated outside of the area already included, the calculations would be correct, but being a part of the same natural flow, the retention of one-seventh would add a per centage of days to the low water period.

In 1845, had the whole drainage been stopped in one immense reservoir, and drawn out daily in equal quantities throughout the year, it would have afforded only 7 feet depth on the bar at Wheeling. And yet there was not a single day that year, when it was less than 2 feet 4 inches, and not a month, when the average was less than 2 feet 10 inches on the bar.

From these considerations, we think that an assumption of 12 inches per annum as the downfall of water that may be utilized in reservoirs in the region named, is quite liberal enough.

(To be Continued.)

For the Journal of the Franklin Institute.

Railroad Bridge Drill, or arrangements for the speedy erection of temporary Bridges on Railroads. By Col. Franklin Hewson, Civ. Eng.

(Reported from personal inspection by Ellwood Morris, Civ. Eng.)

The Reporter having lately witnessed one of Col. Hewson's, "*Bridge Drills*" at Mount Carbon, Schuylkill Co., Pa., requested of him explanatory sketches, and descriptions of these interesting manœuvres, which we now have the pleasure of laying before the readers of the *Journal.*

The general use of timber bridges upon the American railroads, is attended with great inconvenience and loss upon railways of heavy trade, when such bridges are suddenly destroyed by fire or flood, as sometimes happens; and perhaps the more frequently from the former upon roads transacting the largest business.

To have at hand the means of speedily repairing such disasters, by double track temporary bridges of adequate strength to carry the heaviest locomotives, it is often a matter of great consequence, especially to railroads doing a heavy mineral business, on which the sudden destruction of a bridge may disorganize the entire trade in all its extensive ramifications, by land and water, from the mines even to the distant consumer.

The business of a great mineral railroad sometimes exceeds $12,000 a day, or $500 an hour, on such works, the value of *time* is immense, and the necessity of restoring with dispatch, the continuity of the line in the case of an accidental break, is correspondingly great.

This has led the superintending engineers in charge of such works, to consider closely the best means of speedily restoring the track, when broken by the destruction of a bridge

In 1850, Col. Hewson had to replace by a substantial trestling, a bridge of about 150 feet span over a chasm 30 feet deep, upon a double track railway; and though he conducted the repair with characteristic energy, it required 72 hours of time, 1562 days' work of men, and an outlay of $3873, to restore the double track over the Schuylkill River at Mount Carbon, (the place referred to,) where the bridge was suddenly swept away by a tremendous flood.

Upon *four* occasions in Col. Hewson's professional experience, he had occasion to notice that the great expense and loss of time in restoring a broken communication over a river, with a double track railway, was caused:

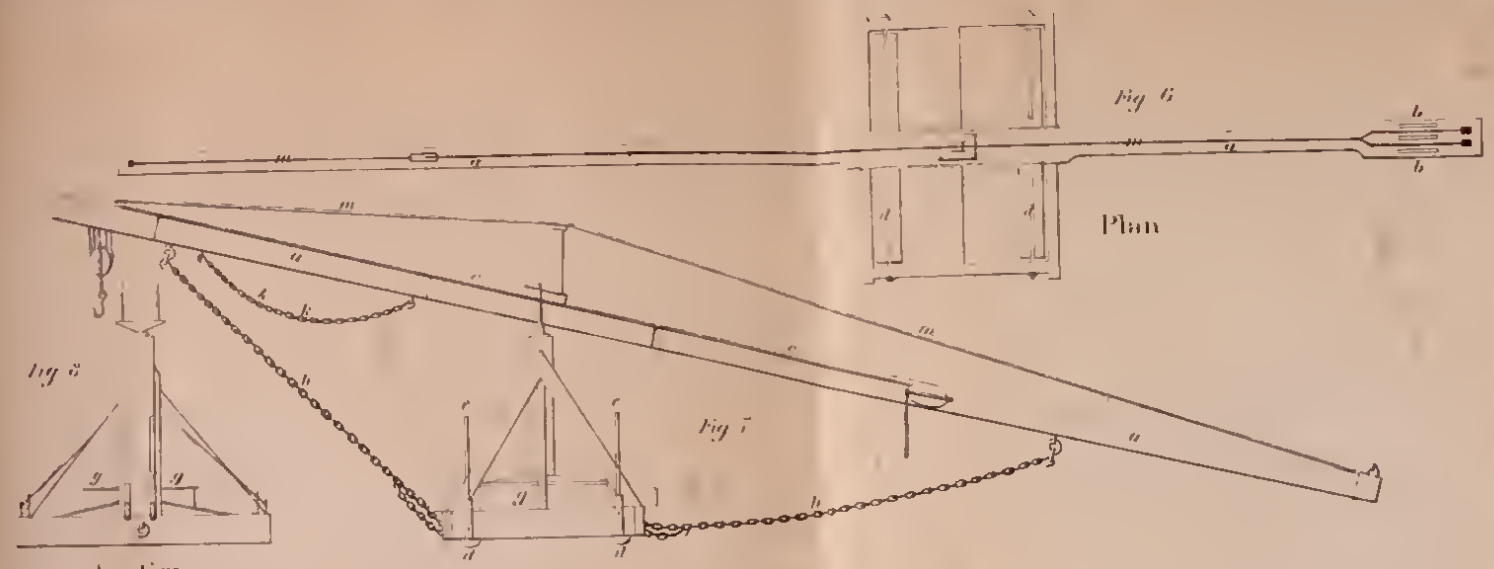
1. By the difficulty of collecting the necessary force, timber, and other materials, and dispatching the same to the scene of disaster.

2. By the enormous prices which had to be paid for lumber, &c., in consequence of the sudden and peremptory demand.

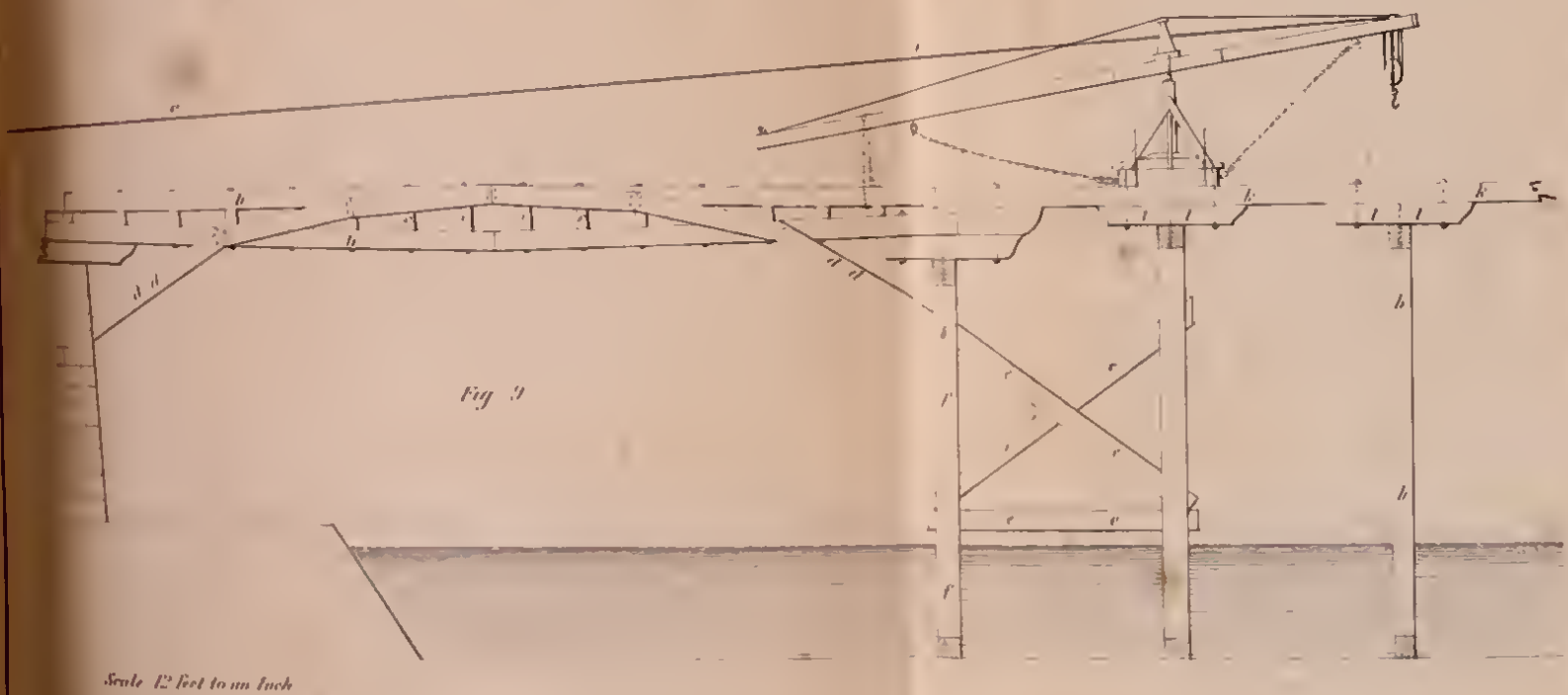
3. By the want of adequately skilled labor, and the confusion incident to the necessary employment of large bodies of inexperienced men, at high rates of wages.

4. By the want of proper appliances for loading, conveying, unloading, framing, and raising the trestle bridges, at the site of the break.

To remedy these evils, as far as practicable, he was led to provide *a magazine* of all of the necessary materials, in a position to admit of

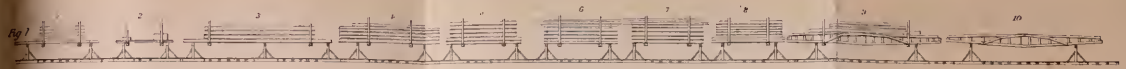


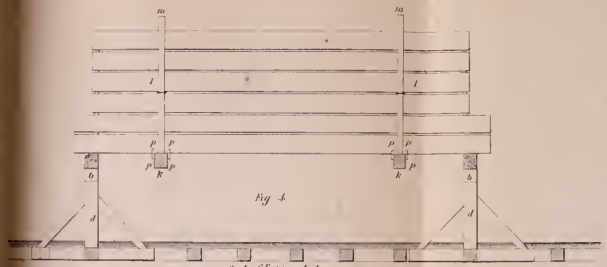
PLAN AND ELEVATION OF GIN.



ELEVATION OF TRESTLE.

TEMPORARY BRIDGE EQUIPMENTS.

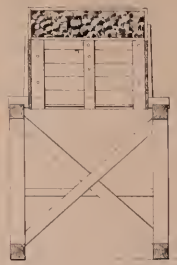




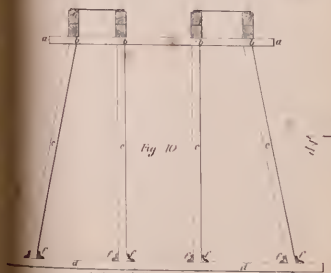
ELEVATION.

STONE CRIBS.

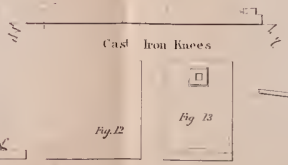
Side view.

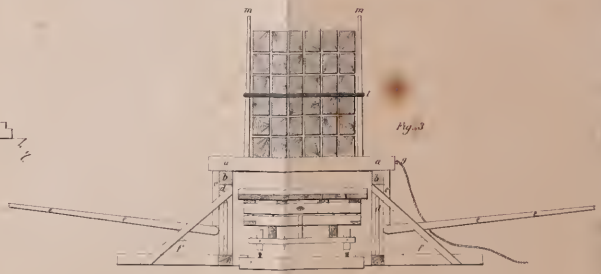


Elevation.



SECTION OF TRESTLE





SECTION.

Scale 6 feet to an inch

being promptly loaded on a railroad train, and to project and organize a system of "*Bridge Drill*," (the subject of the present paper,) under which, a body of sixty men of the permanent roadway force assembled at one point—*at the magazine of materials in fact*—under the direction of the master carpenter of the road, were enough with the assistance of a locomotive train, to load, convey to the scene of action, and erect in a few hours, a substantial trestle bridge, in place of any of the regular railroad bridges, lost by fire or flood.

Col. Hewson has prepared at the carpenter shop of the roadway department of the Upper Schuylkill railroads, above Pottsville, all the materials of wood and iron, all the cross-ties, rails, spikes, &c., all the stone for crib abutments, and other things necessary to form a double track trestle bridge 150 feet long, over a chasm 30 feet deep, of adequate strength to carry the heaviest locomotives and coal trains moving upon it, in opposite directions at the same moment, on the two tracks.

The bulk of the materials are piled *over* a side track upon cross-beams, elevated so as to allow a train of 8-wheeled trucks to be backed under them, forming ten piles of an aggregate length of 342 feet, as shown on Plate No. II., Fig. 1.

In the vicinity of these piles, with a railroad track along its front (to facilitate loading), is a building called the "*equipment house*," where there are stored for use, in a systematic manner, the hoisting machinery, levers, ropes, tackle blocks, bolts, spikes, washers, chairs, gauge bars, and all the tools and implements which experience has shown to be necessary for the erection of double track trestle bridges for railways over rivers—the number and quantities of these necessaries, are fully developed by the "*drills*," and this is one of the advantages of periodic drills; another is, that it enables a small body of men drawn from the ordinary roadway force, by being accustomed to act together, and drilled to particular duties, to perform a great amount of labor, and to restore a destroyed bridge with uncommon dispatch.

The operations we are describing, commence with the assemblage of 60 men at the magazine of materials, under the lead of the master carpenter, and the arrival of a heavy locomotive engine with a train of 15 eight-wheeled trucks, or flats—two of these are placed in front of the "*equipment house*" to receive the hoisting gin, and the small materials, while the other thirteen trucks are backed by the engine, *under* the piles of bridge materials shown in Plate II., Figs. 1 and 4. What follows will be best understood by reference to Plates II and III, and to the subjoined descriptions.

Before giving these, the Reporter will mention here, that Col. Hewson acknowledges in proper terms, the great assistance he has always derived in the bridge drill, and other arrangements—from Mr. Waters S. Chilson, the master carpenter of the Upper Schuylkill railroads, who invented the ingenious hoisting gin, which has been found so efficient in practice, and who was also of great service in the adjustment of other important details—and the Reporter adds, with pleasure, his own testimony to the merits of this skilful mechanic and rigger, who is well known at Pottsville by his successful execution of some very difficult problems in hoisting.

In the event of the abutments of a bridge being swept away, as well as the bridge itself, temporary abutments are erected of crib work, filled with stone. The timber and rag bolts for this work form part of the magazine of materials, and the stone is on hand also in self-discharging bins at a proper elevation above the track, as shown upon Plate II, Fig. 2.

Every thing necessary, in short, is provided and arranged beforehand, and it only remains to supply the manual labor to put the parts together, and the locomotive power requisite for transportation.

Explanation of Details in the Plates.

Plate II, Fig. 1, represents the sections or piles of timber in their order of arrangement in the yard, ready to be lowered on trucks.

Fig. 2, a bin for holding stone to be used in crib-work for foundations, for temporary piers and abutments, &c., &c., capacity $4\frac{1}{2}$ perches. The floor of the bin is at an angle of 13°. The stone is discharged into the cars over an apron, *a a*, which works upon hinges, and is elevated or depressed by means of a rope *b*. Ten bins of this description have been constructed.

Fig. 3, a pile of timber in readiness to be loaded on a truck. The bearer, *a a*, supporting the pile, rests on movable blocks *b b*, placed on top of standards, *d d*, oak levers *e e*, work slides *c c*, raising or depressing the bearers *a a*, the fulcrum *f* of lever is spiked upon the bottom sill of the standard—the grapling rope with a hook at one end is linked by hand to staple *g*, driven into one end of the bearer.

Upright stays *m m*, Fig. 4, prevent the timber in the pile from falling off, they are inserted at each end of the rockers *k k*, these rockers, when the pile is loaded, rest upon the floor of the truck—they are secured from falling, by iron catches or dogs, driven into the outside bottom stick of the pile at *p p*, a $\frac{3}{4}$-inch rod *l l*, keeps the upright stays *m m* from spreading.

Plate III, Figs. 6, 7, 8, show the details of gin, *a a* being the purchase spar, *b b b*, the sheaves in the purchase spar, *c c* the fall or rope 4 inches in circumference, *d d*, the rollers thrown in and out of gear by levers, *e e*, by means of which, the gin can either be put in motion or fixed at rest, *g g*, boxes carrying sledge hammers and spikes, *h h*, check chains to keep the gin from capsizing when in motion.

m m iron truss rods for strengthening the purchase spar, *k k* chains to be detached for hitching to trestle.

Fig. 9, shows a number of trestles erected, and also the arrangement for crossing a canal or passage way of 45 feet clear opening, (should this contingency arise,) in such case a framed beam *b b*, with an arch attached to each side, is placed under each line of the rails in the track, the top and bottom chords are 12 ins. by 14 ins, bolted together through blocks *c c* to the approximate outline of a parabola—these beams are all prepared as per sketch, except the closing pieces *d d* of the arch, these are put in after the beams are on the trestle—*e e*, &c., are braces to resist the thrust on the trestle *f*, temporary light trestles of 6 ins. by 8 ins. timber occupy the channel for a short time, until trestle *f* is erected, and the beams are run upon it.

When no *passage way* is to be kept open, trestles *h* are used exclusively, the rail-joists, *k k*, being 12 ins. by 14 ins. and the bolsters

l l, 12 by 14, 8 feet long. The span between centre and centre of the usual trestles *h*, is 12 feet.

Plate II, Fig. 10 is a section of trestle *h*. The cap pieces *a a*, are prepared with mortises at *b b b b*, to receive the posts *c c c c*, which are framed with appropriate tenons—the outside posts have a batter of 3 ins. to the foot. The posts, after being sawed to the necessary length, (to be ascertained by soundings at the time,) are secured to the bottom or mud sill, *d d*, by means of cast iron knees *f f f f f*, spiked to both the post and mud sill—a bolt is also driven from underneath the mud sill into the posts—the rails for the track rest upon chairs $2\frac{1}{2}$ feet apart, spiked upon the rail-joist, an iron strap resting in a groove in the chair keeps the tracks and the joists from spreading, and act as gauge bars. The substitution of the cast iron knees for the mortises and tenons in the mud sill and posts ; the use of the chairs, to avoid dressing off the joists to receive the iron rails, will save much labor and delay in the completion of the work.

Fig. 11 shows the manner in which the knees are attached to the mud sill and outside post.

Fig. 12 is a section of the knee for the upright posts.

Fig. 13 is a plan of knee.

Details of the Loading Manœuvres.

There are 10 sections or piles of timber and materials whose aggregate weight amounts to 94 tons (of 2240 lbs). The weight of heaviest section$=13\frac{3}{4}$ tons.

Each section, except No. 3, has two bearers, 4 movable blocks, 4 standards, and 4 levers. Section 3 requires 3 bearers, 6 movable blocks, 6 standards, and 6 levers.

The force employed at the loading manœuvre=48 men placed at the outset in the following positions; 7 men to each lever, and one man to each block on section No. 1.

7 men to the intermediate lever, and one man to the corresponding block on the right and left flank of section No. 3.

The train of empty 8-wheeled trucks being backed under the suspended piles from 1 to 10. The foreman takes position on top of section No. 1, and gives the following command. *Section, are you ready? Bowse! Draw blocks!! Plumb up!! Draw levers! Forward!* Same process repeated at ensuing sections.

After section No. 3 is loaded, the intermediate lever men led by their block tenders, drag out the bearers which have fallen upon the tracks, by the aid of short ropes armed with hooks, which they attach to iron staples at the end of the bearers.

Time occupied in loading the 10 piles is three minutes. Their weight is 94 tons, as above stated; while this is in progress, six men load the gin and tools from the equipment house. The locomotive train now loaded, with all the materials necessary for the erection of the temporary bridge, proceeds to its destination.

Unloading and Framing Manœuvres.

Two active men remain upon the trucks to unload—the framers and timber carriers are drawn up at the foot of the embankment, beyond the

reach of the falling timbers, in two files about 10 paces apart, in right and left open order, facing inwards.

The timber and apparatus being unloaded in the following routine.

1st. The float and boat poles are seized by a gang of 12 men and launched upon the water, with a party to take soundings. The balance of the men remaining as they were, until the timbers and plank are unloaded. The planking on which the trestles are framed and launched, are seized and laid down on the ground leading to the water's edge—then the mud sill of trestle placed within three feet of the water—then the uprights or posts and cap pieces which are put together and launched.

12 men are employed in carrying the timbers composing the trestle—8 men frame them together; these two forces also launch the trestle and 3 men float it to the hoisting gin.

Gin Manœuvres at the Abutment and in Raising the Temporary Bridge.

After the gin is launched from the cars, the following commands give the order of its movements.

1st, *Lock levers!* (done by throwing rollers in gear.)
2d, *Forward!*
3d, *Halt!*
4th, *Spring levers!* (by throwing rollers out of gear.)
5th, *Secure purchase spar!* (lashing down the rear end of the purchase spar to the track sills, or some other suitable object.)
6th, *Overhaul tackle and attach trestle!*
7th, *Bowse on the fall!*

When the trestle is erected in its position, the following orders are given:—

1st, *Secure trestle!* (spiking down stays of 3 by 10 inch plank, leading from abutment to cap piece to keep the trestle from falling.)
2d, *Adjust skids for gin!*
3d, *Detach purchase spar!* (unlashing the fastenings at its rear end.)

6 men work the gin, who also put down the stays, adjust the skids, and lash and unlash the purchase spar.

20 men haul upon the fall.

When the three first trestles have been erected, organized parties follow the wake of the gin with the bolsters and rail-joists. 4 men fit down the bolsters, and 8 men deliver and lay down the rail-joists.

The bolsters are carried with the rail-joist on timber carts, which are run upon 3-inch plank, extending from trestle to trestle.

8 men follow the rail-joists with the track laying.

Time unloading, framing, launching, and erecting 3 trestles,	28 minutes.
Time laying down the rail-joists and tracks, . .	20 "
Total time of completing one-fourth, of 150 feet span with the tracks laid—54 men employed,= . .	48 minutes.

This is the time actually occupied in the drills for exercising the men.

At the same rate as above, the double track railway communication over a chasm 150 feet wide, and 30 feet deep, would be restored in 192 minutes—but, to cover all contingencies, we will say *six hours*.

To restore, by means of the preparation, and the drill, in six hours, with 60 men, a broken communication, which has been ascertained on another occasion, to have required 1500 days' work of men, and 72 hours of time, is certainly an important achievement, one that deserves the attention of railroad men, and which must redound to the credit of Col. Hewson, the engineer who devised this "*Railroad Bridge Drill.*"

For the Journal of the Franklin Institute.

On the Failure to Lay the Submarine Cable. By A. C. Jones, Engineer.

Notwithstanding the array of great names, and the much ado about performing so simple an operation as the paying out of a wire rope, (for to call it a cable is a misnomer,) from the stern of a large ship, which, from its length, can be but slightly acted upon by the waves, yet, *in the absence of a gale of wind*, the laying of this cable has resulted in failure from a want of foreknowledge, proper mechanism, and judgment to meet emergencies, such as should have been expected.

The extracts following, were written on the day of the receipt of the telegraphic report of the breaking of the " cable," and were published next day in the "*Ledger*" of this city. As my position, then taken, has been confirmed by subsequent news, I incorporate a portion of these remarks in this paper.

"The '*Times*,' and writers on the other side of the Ocean, speak of the '*ponderous machinery and supporting beams*,' of the paying out apparatus; this ponderousness (being one of the characteristic features of English machinery,) is, no doubt, true in this case. New, what was the work this 'ponderous' machinery had to do? Simply to govern the speed of a wire rope not exceeding in tensile strength an iron wire three-eighths of an inch in diameter, running out at about the speed an active man can walk! At the start, '*the cable ran off the groove of the pulley, got jammed and broke.*' If a cable was to have been laid in a mill-dam, an open sheave would have sufficed, but on the ocean, where yawing and pitching must have been expected, this was a culpable blunder. To provide a safe fixture, it was not necessary to invent, but to take the 'four-sheaved guide,' (no novelty in the United States,) in which two pulleys are horizontal, and two vertical; their four peripheries running together, form a hole for the rope to run through. If (one or more) such guides had been used, let the ship pitch or yaw ever so much, the '*getting off*' of the cable would have been impossible."

And yet this slipping off of the sheaves in the " Cove of Cork," did not cause any precautions to be taken against a similar mishap for only *nine and a half hours before the final rupture.* Prof. Morse writes,*

"We have just had a fearful alarm. Stop her! stop her! was reiterated from many voices on deck. On going up I perceived the cable had got out of its sheaves, and was running out at great speed. All was confusion (!) for a few moments."

"By rope steppers, the cable was at length brought to a stand still, but it strained most ominously, perspiring at every part large tar drops. But it held together long enough to put the cable on its sheaves again."

" There was no difficulty (before starting) in testing the cable, to determine the tensile strain it would bear *without injury to its conducting powers.* Was this done, and provision made that this strain shall not be *exceeded* when paying out the cable? No, for the brakes were applied with so little judgment, that the *whole strength* of the cable was overcome, and the undertaking brought to a stop.

" The amount of the safe maximum strain being determined, and the paying out machinery being of a light character, in *proportion* to the ' cable,' if this regulating apparatus had been placed on guides, or had been pendulous, and attached to a permanent

* Published in the *New York Observer.*

frame by a *dynamometer*, then there would have been no *guess work* when the brakes were applied, for the dynamometer would indicate the exact strain on the cable, and *this strain should regulate the friction of the brakes, without regard to the speed of the ship.*"

Again, Prof. Morse states,

"At 3h. 45m., A. M., Mr. Bright, the engineer, went on deck. Our ship was going on at the rate of four miles two fathoms per hour, and the cable running out at a greater speed; perhaps at the rate of five miles per hour. Mr. B. spoke to the man in charge of the brakes, asking him what strain was upon the cable, to which the answer was returned, about 3000 lbs. Mr. B. directed him to put 100 lbs. more of force upon the brakes, to check the speed of the cable. This was demurred to by the man for the moment, who expressed a fear that it would not be prudent. Mr. B., however, persevered in his orders. The brakes were applied with the additional force, which suddenly stopped the wheels of the paying out apparatus, and, of course, brought the force of the unchecked speed of the ship as an addition to the strain. At this time, too, there was a moderately heavy sea, and, at the rise of the stern by a wave, the cable parted."

"Was there judgment in this? The survey of the bottom has not been so general as to gainsay that there are sudden depressions not yet discovered, which would require more cable than was due to the speed of the ship. But throwing this theory out, every one conversant with the ocean, knows that surface currents are common, and that the speed of the ship through the water and over the ground differs. Again, *deep currents* are known to prevail, and suppose the cable was under the influence of a current, it would be swept out of the direct course, and *more* would be required to be paid out than was due to the speed of the ship." This seems to have been the case at the time of the breaking of the cable, for a subsequent report states, "a lateral current was encountered, which swept the cable out of its direct course: and this report also, gives the position of the other ships at the same time, and it shows that they were mere lookers on. So far as conclusions can be drawn from what had been done, it was the intention to *run an air line course* regardless of currents, &c. Now, as many currents, having different directions, should have been expected on the route, what was the duty of the attending steamers? Common sense would point out that they should act as pioneers, going ahead, proving both deep and surface currents, and by a proper mode of signals, notify those on the '*Niagara*' of their course and strength, and then the direction of that ship could have been such as to neutralize their force. Supposing a man in a boat should wish to lay a wire across the river at a time the tide was running down, if he had any practical judgment, would he row *straight* across, instead of at an angle up stream, when *his course in the boat* would be represented by the arc of a circle, whilst the wire would fall to the bottom in nearly a direct line from shore to shore?"

Prof. Morse also states that,

"We got an electric current through till the moment of parting, so that electric connexion was perfect, and yet the farther we paid out the feebler was the currents, indicating a difficulty, which, however, I do not consider serious, while it is of a nature to require attentive investigation."

It appears that 3100 lbs. was the maximum strength of the cable, for at that strain it broke, and as it had been kept to within 100 lbs. of this breaking point for some time before; and when the cable got off the sheaves before the final rupture, "*it strained most ominously*," it seems to me that the integrity of the conducting wires must have been impaired by these *strains*, particularly as the small copper wires are *straight*, and form a core for the twisted iron wire strands to pass around *spirally*, as in the ordinary rope lay. The effect of a great strain would be to "draw" out the centre wires at their weak parts, to such an attenuated thread as to retard and render "feeble" the electric current, and may not this have been the cause in this case?

The foregoing remarks may be of some service in a future attempt, for there can be no practical difficulty in laying the wire across the ocean with *medium weather*, and nothing short of a gale of wind should exon-

erate for a failure to do it successfully, as there has not been, nor will here be, any difficulty which could not be foreseen and guarded against, by a person of proper experience and judgment.

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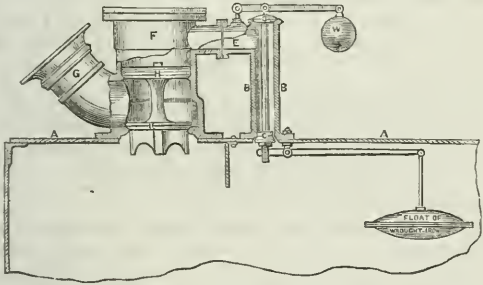
*For the Prevention of Boiler Explosions.**

The following diagram will explain the nature of the invention, for the prevention of boiler explosions, registered by Mr. Joshua Horton, an extensive boiler maker, of Brierley Hill, in this county. Mr. Horton's invention professes to effect two objects,—first, to prevent the pressure of the steam in the boiler exceeding the given pressure more than a pound or a pound and a half, on the square inch, in the case of steam generating rapidly; and secondly, in the case of the water in the boiler sinking below the proper level, to open the valve, so as to provide a sufficient outlet for the steam suddenly generated by water being poured upon the heated plates. The contrivance would, therefore, operate both as a safety valve and a buoy.

In ordinary safety valves, the weight upon the valve always remains, and the extent to which the valve is opened when the steam in the boiler exceeds the given pressure is only such as the difference between the power of the steam and the weight would occasion. In this apparatus, as soon as it comes into operation, the valve is entirely raised, and the whole aperture affords an egress for the excess of steam. The following diagram represents the contrivance, a part being shown in section. It can be fixed to any ordinary boiler, the dimensions given below being suited to a boiler 20 ft. in length and 4 ft. 9 ins. in diameter:—



A A is the upper surface of the boiler; B B is a cylinder 2 ins. in diameter, and about 14 ins. in length; at each extremity is a valve, C and D, united by a stalk, and so constructed, that when one is closed the other is open. The weight W is adjusted to the pressure at which the boiler is intended to be worked; and so long as the pressure of the steam within the boiler is less than that for which the weight is adjusted, the lower valve C will remain open, and the upper valve D will be closed. E represents a cylinder of the same dimensions as the former, at right

* From the London Mining Journal, No. 1134.

angles with and opening into it on one side, and on the other into a larger cylinder F, 6 ins. in diameter, having a bell-mouthed opening, G, communicating with the open air. H and K are valves connected together. When closed, as shown in the drawing, the upper valve H prevents the steam which passes from the boiler by the open valve C, and up the cylinder B B, through E, and to the upper part of the larger cylinder F, from escaping into the air by the mouth G. The valve D also prevents it escaping at the upper extremity of the smaller cylinder. At the same time the lower valve K, at the bottom of the larger cylinder, prevents the steam escaping from the boiler, so long as the two valves H and K are closed. They are kept closed by the steam above the valve H, passing through the valve C, counterbalancing the pressure of the steam in the boiler, which presses upon the valve K, whence this is called by the inventor an equilibrium valve. Now, let the steam in the boiler exceed the given pressure ; immediately the valve C closes, and the steam, which previously kept down the valve H, escapes at the valve D, which is now of course open. No resistance remaining above the valve H, the two valves H and K, which are connected, rise, and open a large orifice for the emission of steam by the mouth G.

The working of the float is readily explained: it is made of iron, sufficiently buoyant to float on the surface of the water, and also sufficiently heavy to close the valve C, to which it is attached, as soon as by the lowering of the water it sinks below a certain level. The large valve is then opened, and steam rapidly blows off, at once warning the engineer of the want of water, and providing an egress for steam suddenly generated by water coming in contact with the heated plates of the boiler, which is the cause of nine-tenths of the boiler explosions which take place.

The trial to which Mr. Horton's apparatus was subjected a fortnight ago proved most satisfactory. The safety valve being properly weighted, the boiler was rapidly heated. The greatest amount gained beyond the fixed pressure or "load" was one pound upon the square inch. The steam being at its height, various gentlemen got upon the boiler, and tested the apparatus so far as its capability of allowing the escape of steam was concerned. The water was subsequently allowed to escape from the boiler, and the main experiment was then commenced. The whole of the water having been drawn from the boiler, the engineer proceeded to heat the bottom plates to a red heat. This being accomplished, all present retired to a distance, awaiting the result. The engineer ensconced himself in a small hiding-place, 20 yards from the boiler, where a hand forcing pump was placed. This pump was 3 ins. in diameter, and had a 4-inch stroke. It was, in fact, such a pump as, under ordinary circumstances, would be used for a boiler of that size. The moment the cold water was injected upon the red-hot plates, a violent puff of steam issued from the bell-mouthed branch of the cylinder described. It was then evident that the danger was passed, as, had not this copious means of exit been provided, in all probability the boiler would have exploded. The equilibrium valve in this case was already open by the lowering of the float, as already described. This would not have been so with the ordinary safety

valve, from the nature of which the load is always upon it, and consequently, before there can in such a case be an escape of steam, the resistance of that load has to be overcome.

The only doubt which has been raised respecting this very ingenious contrivance is, whether the lower valve c will not be liable to be choked by impurities in the water, in which case the upper valve would not open; but experience only can decide this point. The apparatus is to be attached to a boiler in regular work, so as to have its working practically tested by careful observation.

AMERICAN PATENTS.

List of American Patents which issued from July 28th, to September 1st, 1857, (inclusive,) with Exemplifications.

JULY 28.

161. For an *Improvement in Governor for Engines, &c.;* Frederic W. Howe, Newark, New Jersey.

"This invention relates to an improvement of the fly-ball governor for regulating the motion of steam engines, water-wheels, or other metres, by means of which the motion is more perfectly regulated than by any other plan known to me."

Claim.—"The arrangement of the vertical shaft receiving motion from the motor by the differential motion to regulate the supply of steam to an engine, or water to a wheel the said shaft having arms to which are suspended the arms of the fly-balls, provided with cam-like projections, in combination with the sliding cap on the shaft, the friction cone feathered to the shaft, and fitted to a conical cavity of the column or standard, and the spring interposed between the friction cone and the cup."

162. For an *Improved Mode of Fastening Breast-pins;* Charles F. Kolb, Philadelphia, Pennsylvania.

Claim.—"The improvement."

163. For an *Improvement in Machines for Cleaning Rice;* Philip R. Lachicotte and T. B. Bowman, Charleston, South Carolina.

Claim.—"The rotating and adjustable cylinder provided with the screw or spiral flanches, and placed within the cylindrical case, in combination with the stationary wings attached to the bar on the bed; the wings being within the cylinder."

164. For an *Improved Mortising and Boring Machine;* J. M. Jay, Canton, Ohio.

Claim.—"The arrangement of the rack, adjustable brace segment slide rack, and slide table, and in combination with the parallel linked table screws, swivel nuts, and arms."

165. For an *Improvement in Mastic Roofing Compositions;* Samuel K. Lighter and James A. Morrell, Hamilton, Ohio.

Claim.—"The roofing composition, composed of the several substances in the proportions prepared and used."

166. For an *Improvement in Spark Arresters;* Ethebred May, Boston, Mass.

Claim.—"My arrangement of the spark arrester within the smoke-box of the locomotive steam boiler, so that the stack or chimney shall be prolonged down into the smoke-box, and made of wire gauze or perforated plates, and otherwise so constructed that the entire track of the smoke shall be through the gauze or perforated plates."

167. For an *Improvement in Lime Kilns;* John McGregor, Selma, Alabama.

Claim.—"The particular arrangement of the furnaces or fire chambers, in relation

to each other and to the square chamber, when the same are constructed and used in combination with the draft holes and fire flues."

168. For an *Improvement in Projectiles for Smooth Bored Guns;* John L. McConnel, Jacksonville, Illinois.

Claim.—"The improvement of the projectiles known as 'egg-shaped,' which consists in so grooving the surface, that when discharged from any smooth bored gun, with the larger end foremost, the combined effects of the centre of gravity being in front, and the grooves (acted upon by atmospheric pressure) shall give to the projectile an accuracy of flight when so fired similar to that produced by the rifle, and approximating thereto."

169. For an *Improved Spindle for Door Knobs;* Orrin Newton, Pittsburgh, Pa.

Claim.—"The arrangement of the notches on the spindle of the door knob in alternate positions on opposite corners or angles of the squared spindle, in combination with the key and the deep and shallow groove in the shank, together with the depression in the circle plate to keep the key in place, for the purpose of adjusting the length of the spindle of door knobs to different thicknesses of doors, by gradations sufficiently minute to answer all practical purposes."

170. For an *Improvement in Lime Kilns;* Clark D. Page, Rochester, New York.

Claim.—"The combination of the primary grates and the secondary grates with the plate and tubular flue, when the same are arranged to operate in relation to each other."

171. For an *Improvement in Fastenings for Carpets;* Washington H. Penrose, Philadelphia, Pennsylvania.

Claim.—"The use of bars, strips, or rods, with teeth or points either straight, inclined, or hooking, fastened to the floor on which to place the carpet, in combination with strips, bars, or rods, fastened to the wash-board to press the carpet down upon the teeth or points, for the purpose of retaining carpets upon the floor."

172. For an *Improved Bit-brace for Boring obliquely to the Stock;* Charles C. Plaisted, Chicopee, Massachusetts.

Claim.—"A bit-stock in which the socket or part that holds the bit revolves about its axis in an oblique position with reference to the stock by means of the universal joint, or its equivalent, and the adjustable connecting link extending from the socket to the stock. In combination with the above, the cylinder or coupling, by which the axes of the bit and the stock are placed and retained in line with each other."

173. For an *Improvement in the Mode of Raising Sunken Vessels;* John Ponton, City of New York.

Claim.—"The arrangement of the adjustable and changeable supports, operating alone or in connexion with the slides, whereby the tanks may be brought more closely in connexion with, and the sustaining power of them more generally and uniformly distributed along, a vessel or body."

174. For an *Arrangement of Valves and Passages to the Cylinders of Steam Engines;* John A. Reed, Jersey City, New Jersey.

Claim.—"The employment in each cylinder head for the induction, cutting-off, and eduction of steam, of two ring valves, with an arrangement of seats, ports, and passages."

175. For an *Improvement in Guard-fingers for Harvesters;* Adam R. Reese, Phillipsburg, New Jersey.

Claim.—"The combination with a cast or malleable iron guard-finger of the steel plates or cutting edges, when the same are united to the finger in the peculiar manner, and arranged to operate in relation to each other and to the cutters."

176. For an *Improvement in Treating Paper Stuff;* Julius A. Roth, Philadelphia, Pennsylvania.

Claim.—"The combined application of sulphurous acid upon woody fibres with that of the chlorine bleaching agents."

177. For an *Improvement in Machines for Drilling Rock;* Moses T. Rowlands, Pittston, Pennsylvania.

Claim.—"The combination of the vibrating centrifugal hammer with the rotating

spring, and loosely attached drill, arranged to operate in relation to each other, for the purpose of facilitating the drilling of rock."

178. For an *Improvement in Fastenings for Carpets;* Richard E. Schrœder, Rochester, New York.

Claim.—"The plate secured to a stock or directly to the flooring by a joint, the plate having a spring bearing against it."

179. For an *Improvement in Corn Planters;* Charles Schnepf, Lancaster, Penna.

Claim.—"The semi-circular shaped scooping hoes with jointed ends, in combination with the sliders, and operated by the revolving levers."

180. For an *Improvement in Boxes for Receiving Passengers' Fares;* John B. Slawson, New Orleans, Louisiana.

Claim.—"The method of preventing fraud upon proprietors of public conveyances on the part of conductors, drivers, or passengers, by means of the plate or apron, glass plates, lever, and drawer."

181. For an *Improvement in Hemp Brakes;* Stephen Stafford, Carrol Co., Missouri.

Claim.—"1st, Arranging a series of swords in a sash at unequal distances apart, and parallel to each other, the spaces between them decreasing from the upper to the lower sword of the series. 2d, Arranging a series of swords in a sash so that the edges of the under sword will project beyond the edge of the sword next above it throughout the entire series. 3d, The combination of the swords in the stationary sash, with those in the movable sash, when arranged respectively in each sash."

182. For an *Improvement in Machines for Paring and Slicing Apples;* R. W. Thickins, Brasher Iron Works, New York.

Claim.—"The two arbors attached to the rotating head, when used in connexion with the screw shaft collar with arms attached, the rack and geared segment to which the knife arm is attached. Also, the sliding tube and lever with curved arms attached, when combined with the arbors, so that by the same movement of the head, the several parts are made to work automatically."

183. For an *Improvement in Machines for Stuffing Horse Collars;* J. C. Tobias, Lincoln, Illinois.

Claim.—"Attaching the rods to a vertical bar, which is attached to the slide, and to the rack, into which the pinion, or its equivalent, is made to gear alternately, whereby the stroke of the rods or plungers may be cut off at any desirable point, and their reciprocations accommodated to the gradual filling up or stuffing of the bulge or rim of the collar."

184. For an *Improvement in Oscillating Steam Engines;* John Wallace, Pittsburgh, Pennsylvania.

Claim.—"The use of the elastic wedges in contradistinction to the unyielding devices, as an improvement thereon, when constructed, and arranged, and operating on the side pipe."

185. For an *Improvement in Revolving Fire Arms;* James Warner, Springfield, Mass.

Claim.—"The specific device in the end of the slot for preventing the retreat of the lever in the act of cocking."

186. For an *Improved Edge Plane for Trimming the Edges of Boot and Shoe Soles;* Charles Warren, Putnam, Connecticut.

Claim.—"A boot edge plane which has its cutters secured between caps and a central plate."

187. For an *Improved Shingle Machine;* Elbridge Webber, Gardiner, Maine.

Claim.—"1st, The combination of the vibrating frame with the obliquely slotted slide piece and the cam wheel. 2d, The relative adjustment of ratchet and sheave. 3d, The arrangement of the pinions with levers and dogs."

188. For an *Improved Method of Feeding the Bolt in Shingle Machines;* Wm. Wood, Westport, Connecticut.

"The object of the invention is to feed the bolt by a simple mechanism obliquely to

the knife, the ends of the bolt being moved alternately forward, so that the shingles will be cut or rived direct from the bolt in proper taper form."

Claim.—"1st, The employment or use of two screws actuated alternately from the knife frame through the medium of the lever, rod arm of the sleeve or collar, disk provided with ratchet-shaped projections, and teeth or cogs, and the plate. Further, the plate when arranged and applied to the bar, so that it may be readily disengaged from the screws when desired."

189. For an *Improved Gate Latch;* Alfred E. Morgan, Assignor to self, David Todd, and B. Waddle, Ponghkeepsie, New York.

Claim.—"The arrangement and combination together within a suitable case, of a pair of vertically moving locking bolts or bars with a horizontal thumb bar."

190. For an *Improvement in Cultivators;* Harrison Ogborn, Greensfork, and George Taylor, Richmond, Indiana, Assignors to Harrison Ogborn, aforesaid.

Claim.—"The combination of the plough beams with the eccentric axles."

191. For an *Improved Sash Fastener;* F. Tarbell, Assignor to self and D. C. Bicknell, Boston, Massachusetts.

Claim.—"A sash fastener."

192. For an *Improvement in Fixtures for Curtain Rollers;* Lewis White, Assignor to self and Elisha P. White, Hartford, Connecticut.

Claim.—"The application of the friction roller."

ADDITIONAL IMPROVEMENTS.

1. For an *Improvement in Winnowing Machines;* Joseph Keech and Stephen Stillwell, Waterloo, New York; patented June 13, 1854; additional dated July 7, 1857.

Claim.—"The arrangement of the inclined perforated diaphram within the removable blast trunk."

2. For an *Improved Hub Borer;* John Shaerer, Reading, Pennsylvania; patented Jan. 13, 1857: additional dated July 14, 1857.

Claim.—"In combination with the boring shank or shaft, the collar, with its double flanches, one above and the other below the frame, the holes, and the stop."

3. For *Improved Fire Arms;* Frederick D. Newbury, Assignor to Richard V. De Witt, Albany, New York; patented August 12, 1856; additional dated July 14, 1857.

Claim.—"The placing of the tape priming within the chamber of the arm, and operating the priming by the movement of the arm through, and in combination with, the ratchet rod and spring, and pawl spring, or their equivalents."

4. For an *Improvement in Machines for Kneading Dough;* John L. Rolland, Paris, France; patented January 9, 1855; additional dated July 21, 1857.

Claim—"So forming the kneading wings, that they shall in their revolution present alternate concave and convex surfaces to the dough, and whether these concave and convex surfaces are obtained by revolving blade or blades, in connexion with a pressing roller."

5. For an *Improvement in Packing Pistons and Stuffing Boxes for Steam Engines;* Patrick Clark, Rahway, New Jersey; patented June 2, 1857; additional dated July 28, 1857.

Claim.—"The foil packing with cloth cemented or otherwise fastened on one or both sides of it."

6. For an *Improvement in Gutta-percha Stereotype Compositions;* Leonardo Westbrook, City of New York; patented July 19, 1853; additional dated July 28, 1857.

Claim.—"The compound of gutta-percha, gums, and metallic powders combined."

RE-ISSUES.

1. For an *Improvement in the Method of Cutting Out the Uppers of Boots and Shoes;* John Chilcott and Robert Snell, Brooklyn, New York; patented September 13, 1853; patented in Belgium September 16, 1852; re-issued July 7, 1857.

Claim.—"Cutting or otherwise making the leather or other material to form the upper

of a boot by folding without crimping of the form, and having its characteristics, whether the said form be produced by a single piece of material or by the union of two or more pieces."

2. For an *Improved Bomb for Killing Whales;* Nathan Schelfield, Assignor to self and Wm. W. Wight, Norwich, Connecticut; patented March 10, 1857; re-issued July 7, 1857.

Claim.—"1st, Inserting the end of the fuse through a short holding pipe or collar, and securing it firmly therein by compressing the same, and driving or forcing this within the end of the fuse pipe having a conical enlargement at its rear end. 2d, Enlarging the end of the fuse cord by winding it with twine, or its equivalent, so that it cannot be drawn through the pipe, and inserting it in the fuse pipe, either with or without the fastening pipe, and putting gypsum, brimstone, or wax around it within the nut to hold it securely. 3d, The application of the sliding collar, on a projectile carrying a cylindric metallic plate covering the projectile, and either slit to form wings or unslit as a cylinder case, and so constructed that the said collar with the case or wings shall slide to the rear after being discharged from the gun, either by the action of the spring or the resistance of the air to guide its direction. 4th, So constructing and applying these wings, that they may coincide with the cylindric surface of the projectile while in the gun, and that their rear ends may be thrown up therefrom by their elasticity after being discharged, so as to stand in positions diverging from that surface in the rear. 5th, The application of helical or spiral springs on the surface of a projectile to force to the rear a collar (either with or without the guides) after leaving the gun."

3. For an *Improved Machine for Bending the Lips of Wrought Iron Railway Chairs;* The New York Wrought Iron Railroad Chair Co., City of New York, Assignees of (by mediate transfer) Samuel S. Cox, deceased; patented August 8, 1849; re-issued July 14, 1857.

Claim.—"1st, A suitable support for a chair blank, in combination with bending levers or a bending apparatus, and a former, or the equivalents thereof. 2d, A drop hammer, or its equivalent, in combination with bending levers, a former, and a suitable support for the chair blank, or their equivalents, all substantially such, and acting in combination."

DESIGNS.

1. For *Stove Ornaments;* }
2. For *Stove Ornaments;* } Samuel D. Vose, Albany, New York; dated July 7, 1857.
3. For *Stove Ornaments;* }

4. For *Stoves;* John C. Smith, Troy, New York, Assignor to W. Resor & Co., Cincinnati, Ohio; dated July 7, 1857.

5. For *Stoves;* }
6. For *Stoves;* } Samuel W. Gibbs, Assignor to Rathbone & Co., Albany, New York; dated July 7, 1857.
7. For *Stoves;* }

8. For *Grate or Stove Fronts;* John E. Bendix, City of New York, Assignor to S. B. Sexton & Co., Baltimore, Maryland; dated July 7, 1857.

9. For *Cooking Stoves;* James Maguire, Joseph A. Read, and Duncan Wright, Assignors to Charles Gilbert, Philadelphia, Pa.; dated July 14, 1857.

10. For *Stoves;* N. S. Vedder, Troy, New York, Assignor to North, Chase & North, Philadelphia, Pennsylvania; dated July 14, 1857.

11. For *Stoves;* } Samuel W. Gibbs, Assignor to Rathbone & Co., Albany, New York;
12. For *Stoves;* } dated July 14, 1857.

13. For *Parlor Stoves;* E. J. Cridge, Troy, New York; dated July 14, 1857.

14. For *Cooking Stoves;* James R. Hyde, Troy, New York; dated July 14, 1857.

15. For *Clock Cases;* Pietro Cinquinni, West Meriden, Conn.; dated July 14, 1857.

16. For *Iron Railings;* Henry Jenkins, Brooklyn, New York, Assignor to New York Wire Railing Co.; dated July 21, 1857.

17. For *Medallions of Franklin to Mark Pens and Pen Holders;* William Ball, City of New York; dated July 21, 1857.

The claims on the above are for the several shapes, forms, and ornaments.

AUGUST 4.

1. For an *Improvement in Power Looms;* Andrew Allen, Wilmington, Delaware.

"This invention relates to the pattern mechanism for weaving fancy checks, ginghams, and other fancy goods, and consists in certain convenient means of providing for variations of the pattern, and of producing a long pattern with a short pattern chain."

Claim.—"1st, The combination of the step formed indicator, attached to the lifting and dropping mechanism of the shuttle boxes, and the adjustable pins of the pattern chain, for the purpose of controlling the pattern, and affording a greater facility for varying the same than the means heretofore used; 2d, The retarding wheel with its pins combined with the pattern chain wheel or cylinder, to arrest the pattern chain or cylinder, when several picks are required to be made by the same shuttle, or with the same filling thread. 3d, The combination of the pins on the pattern chain or cylinder, and the lever, with the pawl of the retarding wheel, for the purpose of causing the operation of the retarding wheel to be suspended under the control of the pattern chain when desired."

2. For an *Improvement in Trucks for Locomotives;* Levi Bissell, City of N. York.

Claim.—"Attaching trucks having four or more wheels to locomotive engines, so that the said truck is allowed a lateral motion under the engine, and moves upon a centre located between the drivers and the centre of the truck, in such a manner that the relative positions of the four or more truck wheels with the driving wheels, as determined by the straight or curved track, shall cause the body of the engine to assume the correct position relatively with said track. Also, the inclined planes and blocks, or their equivalents, in combination with a truck of four or more wheels having a lateral motion under the locomotive engine.

3. For an *Improvement in Nut Machines;* Robert Brayton, Buffalo, New York.

"My improvement relates to a block or trip consisting of a combination of devices by which the action or movement of the dies are so controlled in the manufacture of nuts and washers that the workman can cause the dies to descend and operate at regular or irregular intervals as the nature of the case may require."

Claim.—"The use of the trigger, spring catch, arm, pin, slide rod, provided with the spring notch, projection, and inclined plane, and in relation to, and being operated by, the foot lever and spring."

4. For an *Improved Walking-stick Gun;* Ira Buckman, Jr., City of New York.

Claim.—"1st, Moving the lock piston backward to effect the cocking of the lock, by revolving the section and its attached spiral cam. 2d, Locking the lock (for retaining the lock piston in position when moved backward to its full extent,) by the locking plate dropping into a transverse groove in the top of the piston. 3d, The construction and operation of the trigger, which enables the trigger to be closed up against the body of the gun while the lock is cocked. 4th, The combination of the locking plate with the trigger, by which the strain of the spring of the piston is brought entirely upon the locking plate, leaving the trigger free from strain or pressure, and enabling the trigger to discharge the lock with slight effort. 5th, The thimble, for the purpose of being moved over the lock catch and trigger, to confine and secure them, so that the lock cannot be operated without first moving back the thimble."

5. For an *Improvement in Vapor Burners;* D. H. Carpenter, Wallingford, Conn.

Claim.—"The bent pipe, or equivalent mingling reservoir for mixing the atmospheric air and vapor, and bringing the jet on a level with the igniting orifice, by which means the proper draft commingling and heat is attained, and the combination therewith of the check-valve, which supplies and regulates the quantity of vapor necessary to produce the maximum effect for the purposes designed."

6. For an *Improvement in Machines for Making Paper;* Patrick Clark, Rahway, New Jersey.

Claim.—"The arrangement of the conducting pipes connecting the pump with the jet pipes, for the purpose of washing the felt and cylinder with the water which has been separated from the pulp, and thus avoid the necessity of introducing for that purpose water from any other source into the machine."

7. For an *Improved Coupling of Thills to Vehicles;* S. T. J. Coleman and I. W. Sibbett, Cincinnati, Ohio.

Claim.—"Securing or adjusting the heads in the loops or hooks, by means of the boxes and bars provided with the screws."

8. For an *Improvement in Coal Stoves;* J. A. Davis, Syracuse, New York.

"This invention consists in certain improvements in the construction or arrangement of stoves more particularly designed for the consumption of bituminous coal."

Claim.—"The combined arrangement of the shallow fire-box, flues, and dampers."

9. For an *Improved Mode of Discharging Cannon;* Josiah Dodge, Dummerstown, Vermont.

Claim.—"The double spring hammer, in combination with the inclined surfaces."

10. For an *Improved Stock for Smoothing Planes;* John F. W. Erdmann, Philadelphia, Pennsylvania.

Claim.—"Placing in the throat of the plane back of the iron, the elastic strip."

11. For an *Improved Mode of Opening and Closing Window Blinds;* Lucius N. Fay and Wm. Mason, Warren, Massachusetts.

Claim.—"Operating the blind by means of the worm-wheel and flanched plate, arranged and applied to the blind and jamb post. Further, attaching the worm-wheel to the rod, which is secured to the lower part of the blind, and curved, whereby the gearing or wheel and flanched plate, or another device gearing into wheel, may be perfectly protected from the weather and dust, in consequence of the rod passing through the underside of the shell."

12. For an *Improved Device for Operating Slats of Window Blinds;* Lucius N. Fay and Wm. Mason, Warren, Massachusetts.

Claim.—"The sliding head or knob placed on the guide rod, which is attached to the cross-rail of the blind, the head or knob being connected with the slat rod by the rod, the slat rod being braced or supported by a rod attached to a rod, and the stile."

13. For an *Improvement in Steam Boilers;* Robert Ferguson, New Orleans, La.

Claim.—"The eccentric arrangement of the water spaces connected with each other, and alternating with the flues of lune cross sections."

14. For an *Improvement in Cultivator Teeth;* F. R. Forsythe, Cape Vincent, New York.

Claim.—"The new manufacture of cultivator tooth, consisting of a sheet steel blade bent to the required form, with a cast iron boss cast thereon."

15. For an *Improvement in the Let-off Motion of Power Looms;* Wm. H. Gray, Dover, New Hampshire.

Claim.—"1st, The combination of the shaft, the endless screw, and worm-wheel, or their equivalents, the friction clutch, the arms attached to the friction clutch, the lever, the cams, and the lever. 2d, The combination of the latch attached to the loose portion of the friction clutch, the levers to detain and liberate the said portion of the clutch."

16. For an *Improvement in Harvesters;* Samuel Gumaer, Chicago, Illinois.

Claim.—"The combination of the blades with the peculiarly constructed platform, and the centre swell reel, when said parts are arranged to operate in relation to each other."

17. For an *Improved File Cutting Machine;* Wm. Halliwell and Levi Osborn, Poughkeepsie, New York.

Claim.—"1st, The combined action of the two carriages, by which the machine is

enabled to remove the file that has been cut (from under the chisel), and automatically to replace it by one to be cut. 2d, The swivel head for holding the chisel, by which, in connexion with the springs, the chisel adjusts itself on the surface of the file. 3d, The levers, cams, and ratchet bar for holding the file in place."

18. For an *Improvement in Bobbins for Roving and Stubbing;* Isaac Hayden, Lawrence, Massachusetts.

Claim.—"Making that portion of the barrel of the bobbin which receives and takes up the second layer of roving, larger than that part of the barrel which receives and takes up the first layer, to compensate for the thickness of the said first layer, and makes the draft on the roving or stubbing uniform."

19. For an *Improvement in Sewing Machines;* Abial C. Herron, Remson, N. York.

Claim.—"The hook and roll, arranged and operating in combination with the needle."

20. For an *Improvement in Fictitious Ivory;* Dr. Ludwig Held, Brooklyn, N. York.

Claim.—"The ivory-like plastic compound, produced principally by a combination of cartilaginous substance or vegetable fibre, with vasic chloride of zinc, and gum resins."

21. For an *Improvement in Cutting Screws;* Peter Hoffner, Rising Sun, Indiana.

Claim.—"In combination with the die stock, the volute or spiral spring."

22. For an *Improvement in Sugar Boilers;* Peter Holbrook, Whitingham, Vermont.

Claim.—"The steam pan, in combination with the sap pan, and the cover to the syrup pan, and the stop-cocks to the steam pan and sap pan, or their equivalents."

23. For an *Improved Device for Protecting the Necks of Horses from Flies;* Ernst L. Kurtz, City of New York.

Claim.—"The stretchers, in combination with the connecting cords, as a fly protection. Also, the weighted cords connected therewith for keeping the protector stretched, and at the same time permitting the free movement of the animal's head."

24. For an *Improved Projectile for Rifled Cannon;* Theodore T. S. Laidley, of the U. S. Army.

Claim.—"The attachment to the main body of an elongated projectile, either solid or hollow, of a covering of some malleable material composed of one or more pieces, embracing the whole or a portion of the exterior surface by imbedding in the cast metal of the shot, the turned-in end, and two or more longitudinal seams or edges, so as to form on the cylindrical surface of the projectile, two or more pockets, having a free space between the cast metal of the shot and the malleable covering, into which the gases at the moment of discharge entering, will force out the covering, and cause it to fill the grooves of the rifled gun, and diminish or entirely cut off the windage of the projectile, whether fired from a rifled or smooth bored cannon."

25. For an *Improved Stop-cock Gas Regulator;* O. L. Lawson and A. A. Starr, City of New York.

Claim.—"The cock with conical plug on which is cone-shaped groove extending entirely around the same, in combination with the mechanical devices, for the purpose of a portable gas apparatus for vessels, cars, &c."

26. For an *Improved Window Blind Slat Holder;* William S. Mayo, City of New York.

Claim.—"The construction and application to the rods of window blinds, of springs or friction pieces of metal to hold the slats in any given position."

27. For an *Improved Device for Operating Window Blinds;* James McMackin, City of New York.

Claim.—"The car, constructed of three pieces provided with the fastening formed of the slotted plate on the piece, and the ledge on the piece, the bar being applied to the blind, and fitted within the sill."

28. For an *Improved Key;* Stuart Perry, Newport, New York.

Claim.—"A bank or store lock key, in which the bits have a movement before, during, and after they have arranged the slides or tumblers of the lock which it is to ope-

rate upon, so that all trace of the exact point or part of the movement of said key-bits, at which such arranging of the slides or tumblers takes place, shall be destroyed, and thus prevent any one but the maker of the lock from making a duplicate."

29. For an *Improvement in Compound Capstans for Ships;* Charles Perley, City of New York.

Claim.—"The combination of the adjustable bearing block with the heaver or windlass, so constructed as to receive the strain and weight of chain cable, and relieve the shaft therefrom, leaving said shaft when disconnected from said heaver or windlass free to rotate and be used for other purposes, without loss of power by the friction of said heaver or windlass, even when the vessel is riding at anchor by said heaver. Also, the power capstan and its coupling fitted to slide endways of the shaft, combined with the heaver or windlass and bearing block, whereby the said power capstan connects the shaft and heaver, or is itself free for use as a power capstan or bit, when connected to, or disconnected from, said heaver or windlass."

30. For an *Improved Machine for Forging Nails;* Samuel J. Seely, City of N. York, Assignor to John M. Hood, Brooklyn, New York.

Claim.—"The employment of two anvil faces placed at an angle with each other, and having a rocking motion to bring them alternately in contact with the article to be forged, in combination with hammers."

31. For an *Improvement in Harvesters;* N. C. Sherman and S. Lightcap, Hazle Green, Wisconsin.

Claim.—"The combination of the peculiar formed adjustable collar with the castor frame, whereby the castor wheel may be at the pleasure of the driver, held rigid in line parallel with the driving wheels, or released so as to turn in the ordinary manner."

32. For an *Improved Propeller Blade;* George W. Swartz, Buffalo, New York.

Claim.—"A propeller blade."

33. For an *Improved Self-feeding Drill;* George C. Taft, Worcester, Massachusetts.

Claim.—"Connecting the screw with the crank by means of the clamp."

34. For an *Improvement in Harvesters;* Charles Tinker and J. A. Sprague, Mantua, Ohio.

Claim.—"The vibrating arm, parallel rod, and connecting rod, in combination with the bent levers, fulcrum wheels, levers, and stops, when the same are arranged to operate in relation to each other (and used in connexion with a self-adjusting cutter and finger bar)."

35. For an *Improved Machine for Beveling Staves, &c.;* John Trahine and Charles Vœbel, New Orleans, Louisiana.

Claim.—"Merely the specific arrangement."

36. For an *Improvement in Boot Trees;* Wm. Upfield, Lancaster, Ohio.

"My aim in this invention is the construction of boot trees whereby the process of lasting may be perfectly and conveniently applied to every part of the boot, and in such a manner as to produce a uniform tension of leather throughout."

Claim.—"1st, The grooves cut in wedges, the side pieces with inclined planes. 2d, Also, the wedge, in combination with post and wedges, or their equivalents. 3d, Also, the nut, the right and left screw shaft, wedges, or their equivalents. 4th, Also, in this connexion, a sleeve, in combination with block."

37. For an *Improvement in Shower Bath Apparatus;* Noah Warlick, La Fayette, Alabama.

Claim.—"The combination of the double armed bolt with the valves, whereby it is made to perform the double function of securing the valve to its seat, and also of operating said valve."

38. For an *Improvement in Fictitious Ivory;* William M. Welling, City of New York.

Claim.—"Forming artificial ivory by thoroughly mixing and combining the articles having equivalent properties while under the operation of heat."

39. For an *Improvement in Elastic Gore Cloth;* Charles Winslow, Lynn, Mass.

Claim.—"An elastic band or gore cloth when made not only of a fabric composed of cement of india rubber or gutta percha, and two pieces of cloth in which the warp and

weft of each piece are made to cross one another diagonally or at an acute angle, but with the edges of the cloth cut and over lapping in lines parallel or approximately so to the weft, and at acute angles with the warp threads, and cemented down to the fabric."

40. For an *Improved Machine for Grinding Knives;* Anthony Hankey and Francis Stiles, Jr., Assignors to selves and Frederick S. Taylor, Leicester, Massachusetts.

Claim.—"Giving to the knife or other article to be ground or polished, a vibratory motion in a plane tangent to the plane of motion of the stone or wheel, or parallel therewith."

41. For an *Improvement in Pedestal for Railroad Cars;* Daniel H. Feger, Assignor to self and Daniel Shepherd, City of New York.

Claim.—"The employment of a loose or movable jaw to the pedestal."

42. For an *Improved Joiners' Plane;* Thomas D. Worrall, Lowell, Mass.

Claim.—"1st, The employment of the clamp lever for securing and bedding the bit. 2d, The clamp lever, as arranged in combination with T strap and nut, for the purpose of regulating and adjusting the bit for cutting, when firmly bedded and secured."

43. For an *Improvement in Cleaning and Carding Moss;* Louis Boudreaux, Thibodeaux, Louisiana.

Claim.—"The combination of the vibrating bed with the bed and the teeth, arranged with relation to the cylinder and roller."

44. For an *Improvement in Tawing and Coloring Skins and Furs;* Harmon Hibbard, Henrietta, New York.

Claim.—"The process of compounding either of the alkalies with the materials, and the process of applying those compounds, or either of them, to pelts, fur, wool, or hair for tawing or coloring."

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45. For an *Improvement in Mowing Machines;* William Bacheller, West Newbury, Massachusetts.

Claim.—"The combination of the thill frame with the cutter frame, when said frames are constructed and used in combination with the supporting wheels and operating wheels."

46. For an *Improvement in Automatic Lubricator for Railroad Car Axles;* Wm. Baker, Utica, New York.

"The nature and object of this invention is to convey the oil, or other lubricating material, from the fountain or reservoir below to the journal, simply by means of the agitation within the box caused by the violence of concussion on the rail, without any dependence on the revolving of the journal or other mechanical agency."

Claim.—"The mode of conveying and applying the lubricating material to the journals of railroad cars and locomotives, by ejecting the same from the reservoir to the journal by the use of the piston, which is moved directly by the jar or concussion when the car or locomotive is in motion, without the aid of capillary attraction, or the use of any absorbent whatever, or of any mechanical agency to be propelled by the revolving action of the journal."

47. For an *Improved Rotary Veneer Machine;* Gilbert Bishop, City of New York.

"This invention consists in cutting veneers and other thin stuff by a knife, with a circular or curved edge in rotation in the line of its edge, while the log from which the veneer is to be cut is vibrated or turnerd towards the knife edge as it passes, so that the knife progressively covers the whole top surface of the log, and cuts the veneer by a continuous rotary drawing, thrusting, and varying stroke of the edge from point to heel, as the log is presented to and brought in contact with it."

Claim.—"1st, The revolving disk and knife placed eccentrically to the disk upon the under surface or upon the edge of the disk, and having a curved edge for cutting the log in the line or direction of the edge of the knife. 2d, The vibrating of the log by means of the log box, arms, cams, and toes, connected with the rotation of the shaft of the disk, so as to present the whole top surface of the log to the edge of the knife

as it passes, and by a continuously varying line of cut or stroke. 3d, The manner of constructing the log box with the movable bottom composed of the call and clamp pieces for holding, shifting, and adjusting the boxes. 4th, The combination of the log box and feed apparatus."

48. For an *Improved Dredging Machine;* Asa Blood, Senr., Norfolk, Virginia.

Claim.—"1st, The dog, in combination with the beam and rod, for the purpose of holding the dredge open in descending, and for relieving its hold by its own weight as soon as the weight is taken off the chain or rope. 2d, The combination of the levers with beam and rod operating for the purpose of opening and closing the dredge."

49. For an *Improvement in Glass Ware Holders;* Hiram Dillaway, Sandwich, Mass.

Claim.—"An instrument composed of a handle, a supporting plate, a yoke, and a spring, combined, whether the yoke be provided or not with an internal holding die."

50. For an *Improvement in Machines for Hulling Cotton Seed;* William R. Fee, Cincinnati, Ohio.

"My invention consists of cutting edges with deep intervening furrows for hulling cotton seed, by a clear cut instead of a grinding or crushing action."

Claim.—"A series of cutting edges with deep intervening furrows, for the purpose of hulling cotton seed by a cutting action, which renders both the screening process and the expression of the oil easy and complete."

51. For an *Improvement in Water Closets;* Lewis Fisher, Buffalo, New York.

Claim.—"The arrangement of the sliding cover with the jointed seat and springs."

52. For an *Improved Arrangement of Feed Rollers for Planing Machines;* Benaiah Fitts, Worcester, Massachusetts.

Claim.—"The internal gear, and the external gear, in combination with the pinion and connecting arms."

53. For an *Improvement in Mowing Machines;* Alanson Gale, Poughkeepsie, New York.

Claim.—"Operating the cutter bar from the master wheel by means of the mechanism, constructed and arranged in relation to the main frame and master wheel of the machine."

54. For an *Improved Machine for Whetting Plane Bits;* Jesse M. Gilstrap, Washington Co., Arkansas.

Claim.—"The use of the bit holder."

55. For an *Improvement in Hominy Mills;* J. B. Gowdy and J. A. Welsh, Xenia, Ohio.

Claim.—"The shaft provided with the beaters and flanches, in combination with the horizontal plate within the perforated case."

56. For an *Improvement in Curtain Fixtures;* Nathaniel S. Graves, Boston, Mass.

Claim.—"When the sides of the groove are dove-tailed, whereby the curtain is securely held to its roller without other fastenings."

57. For an *Improvement in Brewer's Steam Boiling Apparatus;* Adolph Hammer, Reading, Pennsylvania.

Claim.—"Arranging the steam pipe in boiling apparatus in two or more separate and distinct parts or series, whereby either, both, or all parts or series of pipes may be elevated by rotating the same upon axes of rotation at or near the centre of the tub."

58. For an *Improvement in Ships' Capstans;* Samuel Huse, City of New York.

Claim.—"The arrangement and use of the hollow shaft attached at one end to the drum or head, and in combination therewith the movable gear plate, and worked by a pinion on the lower end. Also, in combination with such hollow shaft and movable gear plate, the arrangement of the clutch levers, or an equivalent thereof, for the purpose of connecting such movable gear plate to the barrel, and at the same time disconnecting the head and barrel, or vice versa, and thus changing the action of the capstan to a quicker or more powerful one in a moment, and without changing its motion or displacing any gear."

59. For an *Improved Steering Apparatus of Steam Carriages;* Edward C. Jones, Pittsburgh, Pennsylvania.

Claim.—"1st, Operating the clutches of the driving wheels by the same parts by which the steering wheel is operated in such a manner as to disengage (by operating the said clutches,) the one or the other of the driving wheels simultaneously with the turning of the steering wheel to the right or left. 2d, The arrangement of the lever, links, levers, with their arms connected therewith, by a but hinge joint and the springs, when constructed, combined, and operating in connexion with the pinion, and the clutches. 3d, The arrangement of a pivot in or near the centre of the steering wheel, and passing through its axle."

60. For an *Improvement in Ships' Capstans;* David Knoulton, Camden, Maine.

Claim.—"The combination of the gear at the bottom of the capstan (when made and applied so as to be rotated or be made fast alternately) with the gear or pinion attached to, and revolving with, the capstan head, they being connected by gears."

61. For an *Improvement in Automatic Lubricator for Railroad Car Axles;* Alexander B. Latta, Cincinnati, Ohio.

Claim.—"The arrangement of the lever rod and spring, combined with the car or their equivalents, for actuating the lubricator by the vertical vibrating motion of the cars."

62. For an *Improved Valvular Arrangement in Faucets, etc.;* John C. Macdonald, Cincinnati, Ohio.

Claim.—"The arrangement of the valve stem, the nut, the valve guide, the screw and the cap or screw, and nut guide, which also contains the stuffing-box."

63. For an *Improvement in Silk Dyeing Machines;* Nicholas Mary, Sen., Philadelphia, Pennsylvania.

Claim.—"The combination of the steam chambers with the friction surface rollers, for preparing and dyeing the material."

64. For an *Improvement in Instruments for Indicating the Depth of Water in Ships;* G. B. Massey, Mobile, Alabama.

Claim.—"The arrangement of the parts relatively to one another for united operation to produce a leakage alarm and register for ships, to wit, the bell arranged on a firm part of the vessel, the spring within the barrel, and the barrel within the belt; the float chain on the spring barrel, the hammers within the belt, the pin wheel, and the mechanism by which they are operated and controlled on the arbor of the spring barrel, and the mechanism which measures the rise and fall of water alongside the signal mechanism, and so as to be actuated by the spring which sounds the alarm."

65. For an *Improvement in the Manufacture of Sulphuric Acid;* Alfred Monnier, Camden, New Jersey.

Claim.—"The process of preparing native metallic sulphurets, by pulverizing them and mixing them with the substances described, in order to extract all or nearly all the sulphur from them for the purpose of making sulphuric acid."

66. For an *Improvement in Reefing Top-sails;* James W. Norcross, Boston, Mass.

Claim.—"My arrangement of reef tackles, the same consisting in fastening the said reef tackles to the sail at or near the reef band, thence leading them upward through sheaves or blocks, or their equivalents, applied to the top-sail yard, and from thence extending the said reef bands upward and through blocks suspended to the cross-trees or that part of the top-mast just below them, and thence leading the reef tackles downward and fastening them to the top-sail yard at or near its middle."

67. For an *Improvement in Filtration Press for Expressing Liquids from Substances;* William Needham and James Kite, Vauxhall, England.

Claim.—"The exclusive use of the combination of parts, forming apparatus or machinery for expressing liquids or moisture from substances."

68. For an *Improvement in Bathing Apparatus;* John K. O'Neill, Kingston, New York.

Claim.—"The combination of the annular pipe, or its equivalent, with the flexible connecting pipe, or its equivalent."

69. For an *Improvement in Sausage Cutters;* Jacob Peters, Hummelstown, Pa.

Claim.—"Only the arrangement of two sets of knives working into each other with motions in opposite directions."

70. For an *Improvement in Gas Generators;* Allan Pollock, Washington, D. C.

Claim.—"1st, The peculiar form and arrangement of the retort with the grooves, for the passage of the gas from the vent holes of the canister to the gas chamber. 2d, The canister with the vent holes, by which I take the gas from the centre of the canister, the lid extending down to or near the top of said vent holes."

71. For an *Improvement in Safety Tops for Railway Cars;* Albert Potts, Philadelphia, Pennsylvania.

Claim.—"1st, The mode or manner of constructing railway passenger cars, with the tops and bodies disconnected. 2d, The metallic plates or grooved and beveled rails for uniting the tops with the body of the car. 3d, The combination of the pendulums for the purpose of holding the tops to the bodies of the cars."

72. For an *Improvement in Mechanism for Operating Railroad Car Brakes;* E. R. Roe, Bloomington, Illinois.

Claim.—"The combination of the 'anchor' in its connexion with the arm and the pin, and operated by the cams and pins, in connexion with the wheel."

73. For an *Improvement in Mash Cooling Machines;* Jesse Shilling, Troy, New York.

Claim.—"The hollow arms, with the hollow teeth attached, said teeth, some or all, having lateral shares or projections attached, the hollow arms being attached to a rotating shaft, and communicating with a pipe which is connected with a fan-box."

74. For an *Improvement in Dress of Grinding Surfaces for Grain Mills;* Otis W. Stanford, Cincinnati, Ohio.

Claim.—"The alternated channels and grinding surfaces, as represented, on the surfaces of the plate, when said alternate channels and grinding surfaces are made concentric with the centre of motion given to the plate."

75. For an *Improvement in Lime-Kilns;* Daniel Stephens, Elmira, New York.

Claim.—"The diagonal or oblique flues with sloping bottoms, in combination with the shaft and its branches."

76. For an *Improved Filter;* John A. Thompson, Cayuga, New York.

"The improvements consist in the direction of the water from the side of the vessels used in the operation, and the more perfect passage of the same through the filtering material, the retaining of all the sediment and impurities in the first vessel, and ready removal of the same."

Claim.—"The combination of the receiving vessel or upper filter, the reservoir with the flanch or rim, and attachable air and draft pipes to same, not confining myself to any particular mode or material which shall produce like effects and results."

77. For an *Improvement in Steam Gauges;* D. G. Wells, City of New York.

Claim.—"The use of a flattened tube when constructed and arranged in layers."

78. For an *Improved Tea Kettle;* Wm. Westlake, Milwaukie, Wisconsin.

Claim.—"A tea kettle."

79. For an *Improved Finger Bar for Reaping and Mowing Machines;* John T. Whitaker and Calvin D. Read, St. Charles, Illinois.

"Our invention consists in the use of a rolled tubular finger bar of peculiar form and construction, whereby the efficiency and strength of the machine is greatly increased, and its weight materially lessened."

Claim.—"A tubular finger bar."

80. For an *Improvement in Adjustments for Try-squares;* Joel Whitney, Winchester, Massachusetts.

Claim.—"The flattened pin working in the slot, in combination with the eccentric pin."

81. For an *Improved Machine for Smoothing Planed Wooden Surfaces;* Baxter D. Whitney, Winchendon, Massachusetts.

Claim.—"The scraper, in combination with a mechanism for the purpose of carrying the wood forward in contact with the scraper."

82. For an *Improvement in Machines for Polishing Stone and Glass;* George H. Wood, Green Bay, Wisconsin.

"My invention consists in the peculiar means employed for polishing stone, glass, and other materials in an expeditious and perfect manner."

Claim.—"The polisher, in combination with the adjustable guide and gauge frame, and the reciprocating carriage, when the whole is arranged to operate conjointly."

83. For an *Improvement in Spring Lancets;* Jefferson T. Martin, Administrator of Wm. Parkinson, dec'd., Marshall Co., Virginia.

Claim.—"The application and adjustment of the spring, being the re-action spring, by which the blade is instantly drawn back."

84. For an *Improved Press for Shearing and Punching;* Benjamin F. Hooper, Assignor to self and Ransom Ballou, Jr., Albany, New York.

Claim.—"The employment of the beam having an inclined slot in its extremities carrying the pins on which the punch and shears are suspended."

85. For an *Improvement in Machines for Marking Time of Attendance of Workmen;* Benjamin T. Harris, Assignor to John McKillop, Brooklyn, New York.

Claim.—"1st, The combination of the registering surface, operated by clock-work, with the movable markers. 2d, The combination of the movable markers and their arms, with the indicators and their concomitant parts."

86. For an *Improvement in Machines for Moulding Bricks;* I. Z. A. Wagner, Philadelphia, Pa., Assignor to P. H. Watson, Washington, D. C., Assignor to E. S. Renwick, City of New York.

Claim.—"The combination of the mould-box with a core, and an annular bottom or piston."

87. For an *Improvement in Sewing Machines;* Wm. C. Watson, Assignor to self, G. H. Wooster and J. W. Gregory, City of New York.

Claim.—"The improved device for seizing the loop, and holding and presenting it for the passage of the needle, consisting of a vibrating hook, in combination with a gripper or hold-fast, so arranged and operated as alternately to close upon the loop after being engaged by the hook to draw back the said loop, and to release the same after the passage of the needle through."

88. For an *Improved Machine for Turning Spools;* Augustine D. Waymoth, Assignor to self and H. W. Page, Fitchburg, Massachusetts.

Claim.—"The combination of a stamping or milling wheel with mechanism for turning a spool from a piece of wood, the said wheel being arranged so as to mill, engrave, or indent the end of a spool while said spool is being made, or before it is separated from the stick. Also, the combination of the two pitmans and the lever plate or wheel, or equivalent devices, with a lever for elevating the severing cutter, and that for carrying the body cutter, whereby the said body and severing cutters are made to operate, that is, during one single forward movement of the lever connected with the severing cutter. Also, the tapering screw-chuck."

89. For an *Improvement in Hot Air Furnaces;* Daniel P. Weeks, Boston, Assignor to self and Eben Seavey, Charlestown, Mass.

Claim.—"The combination and arrangement of the parachute radiator, air chamber, and pipes with the fire chambers, and the reverberating chamber, having smoke passages or pipes applied to the same, and leading into the radiator. Also, the manner of constructing the radiator, viz: with a tapering tunnel, an annular deflecting dome, and a discharge passage or pipe. Also, constructing the air chamber with a bulb or projecting part, when such chamber is arranged within a reverberating chamber made to communicate with the discharge pipes, and a chamber of combustion, and to surround the radiator opening at its lower end into the said chamber of combustion."

90. For an *Improvement in Winnowing Mills;* Manasseh Grover, Clyde, Ohio, Assignor to self and H. Seely, Hudson, Michigan.

Claim.—"Arranging in the throat or opening of the fan case, a series of troughs or scoops, in combination with the obtuse angles of the fan blades."

91. For an *Improvement in Machines for Pegging Boots and Shoes;* Benjamin F. Sturtevant, Assignor to self and Elmer Townsend, Boston, Mass.

Claim.—"The bell-shaped feed wheel and its arrangement with reference to the awl and peg wood carrier, and provided with one or more ranges of holes, the awl being made to work at an inclination to the axis of the feed wheel, or from the axis towards and through the rim of the wheel. Also, the mode of feeding the shoe along, that is, by the awl, or its equivalent, and the feeder wheel, the latter not only assisting in feeding the shoe along by the pressure and action of the ranges of tapering holes, but in holding the shoe in position while the awl is raised out of the sole."

92. For an *Improved Expanding Auger Bit;* Asa Weeks, Assignor to self and Orrin W. Fiske, South Boston, Massachusetts."

Claim.—"Combining with the double threaded screw and arranging on the split tapering shank, a rotary sleeve and its screws."

93. For an *Improved Drop Press;* Wm. Wilson, Jr., Assignor to Wilson, Green, & Wilson, Jr., Brandywine, Delaware.

Claim.—"The employment of the spring when so arranged with the drop, as to effect the delivery of the article stamped."

94. For an *Improvement in Setting Porcelain Teeth;* Martin Luther Wright, Cleveland, Ohio.

Claim.—"The making of parts of full sets or parts of half sets of teeth for either the upper or under jaw, where one or more teeth are good and permanent, and where one, two, or more may be skipped, making the whole plate and teeth of one piece of porcelain."

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95. For an *Improvement in Tubular Shafting for Mills, &c.;* Zachariah Allen, Providence, Rhode Island.

Claim.—"The improved hollow shafting, forming a continuous line of mill shaft and pulley or belt drum."

96. For *Improved Rotary Planing Cutters;* H. H. Baker, New Market, N. Jersey.

Claim.—"The recess in the face of the cutter wheel."

97. For an *Improvement in Gas Regulators;* John H. Cooper, Philadelphia, Pa.

"My invention has for its aim the production of a gas regulator, the flow of gas through which shall be direct, and which shall afford a ready means of disposing of the water which accumulates from the distributing pipe. It has for its further object the balancing of the pressure on the cut with the least amount of friction possible."

Claim.—"The double rimmed inverted cup with an inclined surface; said cup having a valve and an opening formed by the rim, when the said opening and valve are concentric with the inlet formed by the inner flanches of the casing."

98. For an *Improved Raking Apparatus for Harvesters;* Israel Dodenhoff, Bloomington, Illinois.

Claim.—"The rake, in combination with the platform and stationary and elastic guides. Also, the gate, in combination with a rake, traveling in a horizontal endless track."

99. For an *Improvement in Grate Bars of Furnaces;* Edward Dugdale, Burlington, New Jersey.

Claim.—"The flexible grate bars, when used in connexion with a raising and lowering or shaking apparatus, so as to change the position of the fire, prevent the baking of the coal, and sift out the ashes, cinder, &c."

100. For an *Improved Machine for Bending Metal Plates;* E. L. Gaylord, Terrysville, Connecticut.

Claim.—"The combination of the reciprocating bed, forming or bending die, and rollers, arranged so as to operate conjointly."

101. For an *Improvement in Cooking Stoves;* Sidney Godley, Lockport, New York.

Claim.—"1st, The arrangement of the stove with the movable adjusting plate, which is one of the entire sides of the stove, and detaching it for a cover to the baker, when the same is used with stove, the whole when arranged forming a complete cook and baker. 2d, The adjustable extension chamber to be attached to a stove, when it is desired to extend its cooking and heating capacity, the stove being a complete stove with or without the attachment."

102. For an *Improvement in Hoops for Ladies' Skirts;* Charles S. Goodman, Washington, D. C.

Claim.—"Constructing the hoop of spools or tubes as strung upon an elastic cord, or its equivalent, to give elasticity to the hoop, with the ends of the spools cut on a line radiating to the centre of the hoop, whether the same be made of wood or any other substance to produce the same effect."

103. For an *Improvement in Manufacturing Metal Buttons;* Jared O. M. Ingersoll, Ithaca, New York.

Claim.—"The manner of securing the points to and through the button by passing said points, when bent, through openings in the collet of such buttons, and fastening said points and collet securely in place by pressure."

104. For an *Improvement in Eye Shading Apparatus;* Francis H. Jones, Federalsburg, Maryland.

Claim.—"The arrangement in the top of the tube of the ventilator and light graduating contrivance, when the tube is designed for use."

105. For an *Improvement in Percussion Powder;* Magnus Kling, Reading, Penna.

Claim.—"The combination of antimony with chlorate of potassa, oxalic acid, and glue, mixed in the proportions for a composition for the manufacture of percussion caps for fire arms."

106. For an *Improved Machine for Dressing Saws;* Philo Maltby, Dayton, Ohio.

Claim.—"The devices, or their equivalents, for clamping and holding the plate of the saw, in combination with the devices, or their equivalents, for holding, operating, and feeding the tool to plane the teeth of the saw. And in combination with the devices, or their equivalents, for holding the plate and planing the teeth of the saw, the apparatus, or its equivalent, for operating and feeding the drill by power or motion derived or communicated from the planing apparatus, so as to drill the holes in the plate at the same time the teeth are planed."

107. For an *Improvement in Railroad Car Brake;* James Mitchell, Osceola, Iowa.

"This invention consists in a peculiar combination of devices for causing the descent of brake shoes upon the rails and in front of the car wheels on the departure of the forward car from the track."

Claim.—"The combination of the lever, detent, hooked rod, adjustable collar, standard, rod, slotted table, and bent lever, when said parts are arranged for joint operation with each other and with the shoe suspending apparatus."

108. For an *Improved Machine for Bending Metal Plates;* Julius Perry, Plymouth Hollow, Connecticut.

"The object of this invention is to roll into sharp angular form at one operation, the edges of bent metal plates, so that the plates will not require to be manually operated upon, or at least not materially, after being drawn through the machine."

Claim.—"The two rollers and bed placed in positions relatively with each other. Further, the rollers and bed, in combination with the die or draw plate."

109. For an *Improvement in Inhaling Apparatus;* John C. Schooley, Cincinnati, Ohio.

Claim.—"The so combining the ice receptacle with the openings, and so arranged that the outside atmosphere after being cooled and dried by passing over ice, or its equivalent, within said receptacle, can be inhaled into the lungs."

110. For an *Improvement in the Construction of Artificial Hands;* Wm. Selpho, City of New York.

"This invention consists in the manner of constructing the joint on which the fingers move, and connecting the spring and parts that move the said fingers; also, in the manner of opening the fingers by a motion derived from the shoulder of the opposite arm."

Claim.—"Constructing the skeleton fingers on the metallic cross pipe set in eyes in the line of the knuckle of the hand, and provided with the contractible spring, acting on one side of said pipe to close the hand. Also, opening the artificial hand on one arm by a motion derived from the shoulder of the other arm of the wearer, said motion acting through the shoulder loop, strap, and cord, or their equivalents."

111. For an *Improvement in Telegraphic Repeaters;* John E. Smith, Troy, New York.

Claim.—"The connexion of a battery at each station with the line wire, and with two local cross connexions, in such manner that by means of the key and relay lever, the cross connexion through the register magnet, and the other cross connexion, are alternately broken, and the battery thrown upon the main line, and its current caused to operate the relays on the line wire, like a main current, till shut from the line by the relay lever, whereby each battery is made to perform the duty of an ordinary local battery while not wanted on the line wire, and to perform the duty of the main battery while not wanted as a local. Also, the key placed on the local circuit and constructed to open and close the said circuit in two branches to give two directions to the current over the line wire."

112. For an *Improvement in Railroad Rail;* Edward W. Stephens and Richard Jenkins, Covington, Kentucky.

"Our improvement consists in forming a 'T rail,' with an aperture extending lengthwise through the thick upper portion of the rail."

Claim.—"The tubular T railroad rail: that is to say, having the two portions of its web welded together at the neck, and branching to the outer and inner edges respectively of the tread or track of the rail."

113. For an *Improvement in Bakers for Cooking Stoves;* P. P. Stewart, Troy, New York.

Claim.—"The employment of the plate or pan with its legs to rest on a stove plate, its projecting wires at the angles to guide the reflector, and its aperture or slot in the middle of the length, in combination with the tin reflector enclosing the whole, and leaving a space all around, which together with the slot in the middle of the plate or pan will permit the heat radiated from the stove plate to be reflected on the top of the articles to be baked or roasted."

114. For an *Improved Shears for Cutting Metal;* Timothy F. Taft, Worcester, Mass.

Claim.—"The rolling lever upon an inclined plane, which is upon the side or blade holder."

115. For an *Improvement in Hot Air Registers;* Joseph V. Tibbetts, City of New York.

Claim.—"The valves placed in the ascending pipe at or near the centre with independent movements."

116. For an *Improved Machine for Twisting Curb Chains;* Lauriston Towne, Providence, Rhode Island.

Claim.—"The combination of the vibrating spiral die and stationary holding die plates, or their equivalents."

117. For an *Improvement in Portable Horse Powers;* Daniel Woodbury, Rochester, New York.

Claim.—"Poising the frame of said horse power upon a pair of journals or spindles, which are received into the hubs of suitable transporting wheels, when the said frame is combined with the jointed bars and the jointed frame."

118. For an *Improvement in Tanning Liquids;* Leo de La Peyrouse, Paris, France, Assignor to Michael J. A. Guiet, City of New York.

Claim.—"Combining with the tanning solution or liquor the chloride of tin or its equivalent, in which the skins are handled."

119. For an *Improvement in Self-acting Mules for Spinning;* George Wright, Grafton, Massachusetts.

Claim.—" 1st, Giving a second draft to the yarn after the delivery of the ends has ceased. 2d, Operating certain motions upon the carriage, such as braking up the spindles, backing off the yarns, and operating the upper faller by the taking-in scroll chain. 3d, Running the drum band over a vibrating arm upon the carriage, and clamping it thereto at intervals for the purpose of backing-off and winding up the yarn. 4th, Hanging the stop which holds the carriage stationary while the second twist is put into a spring, so that it may yield in the manner to prevent injury or breakage of the yarn. 5th, Varying the obtuseness of the cone upon different portions of the cop by means of the block."

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120. For an *Improved Filter;* Wm. W. Ayres, Worcester, Massachusetts.

Claim.—" The combination of cylinders with the spindle, when constructed with reception and discharge cavities, openings, and channels."

121. For an *Improved Machine for Wetting and Cutting Paper for Printing Presses;* Moses S. Beach, Brooklyn, New York.

" The object of this invention is to take paper from an endless sheet or reel, wet or moisten it suitably for purposes of printing, cut it off in sheets of any desired size, and deliver them to the impression cylinder of the printing press, without the intervention of hand labor. It may be applied, however, to other purposes, where moistening and cutting into sheets are desirable."

Claim.—" 1st, Simultaneously cutting or moistening both sides of the paper. 2d, Leaving the paper dry at the point or line of cutting. 3d, Catching the knife when retired within the circumference of the cylinder, retaining it while so retired, and releasing it from the operation of cutting by means of the catches, the springs, and the tripping pins. 4th, Combining the cutting apparatus with the wetting cylinders or rolls."

122. For a *Combination of Watch Keys with Finger Rings;* Elihu Bliss, Newark, New Jersey.

Claim—" A watch key and finger ring combined."

123. For an *Improvement in Machinery for Manufacturing Hat Bodies;* Joseph Booth, Newark, New Jersey.

Claim.—"The rotating flat hurdle, having its perforated surface divided, in combination with a picking or blowing apparatus, and air exhausting apparatus. Also, the arrangement of the fan shaft upon the spindle of the revolving hurdle."

124. For an *Improved Method of Hermetically Sealing Cans;* Wm. Borrman, Cincinnati, Ohio.

Claim.—" The mode of hermetically sealing cans by means of the central screw stem and sheath, in the combination with the pliable lid, nut, and gaskets."

125. For an *Improvement in Umbrellas and Parasols;* Sheldon Canfield, Derby, Connecticut.

Claim.—" The form and construction of the clasp, it being made of a single piece of thin sheet metal, so folded in the middle, either by a machine or otherwise, as to form on the under side of the clasp two flanches, each consisting of a double thickness of sheet metal. Also, the clasp as applied to umbrellas and parasols."

126. For an *Improved Device for Piercing Blind Slats to receive the Staples;* John Carpenter, Stonington, Connecticut.

" My invention consists of a peculiar arrangement of machinery for cutting the tenons on both ends of blind slats, and piercing them for the wire staples simultaneously."

Claim.—" The application of the piercing points to the sliding dog, so that the slat may be pierced for the wire staples by the same action as that by which they are held secure for forming tenons thereon."

127. For an *Improvement in Separating Ore;* Thomas J. Chubb, City of New York.

Claim.—" Effecting a separation of a thin layer of finely pulverized ore into layers, or strata of different specific gravity, upon a perforated bed, or its equivalent, by means

of applying light minute puffs of air up through the interstices of the said bed, and through a thin layer of ore evenly spread and resting thereon, for the purpose of gently agitating the said layer of ore, and floating the lightest substances therein to the top thereof, and allowing the heaviest substances therein to gravitate to the bottom of the said layer on the said bed."

128. For an *Improved Swage for Setting Saw Teeth;* Pearson Crosby, Fredonia, New York.

Claim.—"Forming the acute angle of the acting face of the swage, to bring the cutting edge of the saw teeth to a sharp angle by making the said swage in two parts."

129. For an *Improvement in Brick Machines;* P. S. Devlan, Reading, Pennsylvania.

Claim.—"In combination with a clay receptacle supplied by a positive feed, and a rocking or partially rotating mould wheel, the plungers, the first for pressing, and the second for delivering the pressed brick, the parts being so arranged as that said wheel will rock or roll from one plunger to the other."

130. For an *Improvement in Washing Machines;* Hiram F. Everitt, Benton, Pa.

Claim.—"The combination of the adjustable reel, fluted concave, and swinging rubber."

131. For an *Improvement in Self-waiting Tables;* Wm. B. and Jonathan H. Farrar, Evans Mills, North Carolina.

Claim.—"The central revolving disk (when fitted down into the circular hole), constructed with a thin lip projecting horizontally from the upper portion of its circumference, and with a rib of ring-form projecting from its underside and near its circumference."

132. For an *Improved Pin Sticking Machine;* Thaddeus Fowler, Waterbury, Conn.

Claim.—"1st, The endless chain with its racks, in combination with the flanched cylinders (whether with or without the revolving hopper). 2d, The combination of the endless chain with the revolving hopper."

133. For an *Improvement in Ships' Berths;* Henry Getty, Brooklyn, New York.

"My invention is designed especially for use on ship board, where two things are very essential in a berth, to wit: a capability, when in use, of maintaining a horizontal position, no matter what may be the motion of the vessel, and when not in use, of being turned up against the wall, so as to be out of the way, and thus give increased space for moving round in small state rooms."

Claim.—"Providing at each end or side of a state room of a steamer or vessel, a pivoted bracket which is capable of vibrating in the path of a circle a certain distance, and connecting the berth to said brackets through swinging vertical screw rods, metal or rubber springs, and hollow standards."

134. For an *Improvement in Washing Machines;* Wm. M. Hammond, Jonesville, Michigan.

Claim.—"The bed formed of loose weighted balls covering the tub bottom, in combination with the cellular disk rubber."

135. For an *Improved Method of Rendering the Mouths of Trunks, Mail-bags, &c., Water-tight;* Charles H. Hinckley, Stonington, Connecticut.

Claim.—"The application of the inflated casements or ribs, composed of india rubber, or other suitable material, to the sides of contact of clasps for bags or cases, so that by their yielding contact the clasp may be closed so as to be impervious to water."

136. For an *Improvement in Hay and Manure Forks;* William Jones, Speedsville, New York.

Claim.—"Casting the ferrule upon, or otherwise securing it firmly to, the outer end of a socket, in which are formed slots for the reception of the tangs of the tines of a fork to prevent lateral working, when used in connexion with a wedge, cast or otherwise, formed between the recesses made for the tangs to prevent end play, and screws, for the securing of the tines, socket, and handle to each other."

137. For an *Improvement in Steam Pressure Regulators;* Lucius J. Knowles, Warren, Massachusetts.

Claim.—"Supporting the disk by concentric rings and rods."

138. For an *Improved Projectile for Rifled Cannon;* Theodore T. S. Laidley, of the U. S. Army.

Claim.—"The formation of a cast iron shot or shell with a wrought iron covering of a portion or whole, which is fastened to the main body of the shot at or near both ends, by imbedding one or both turned in ends in the cast metal of the shot, or by means of dowels, pins, or rivets, imbedded in the cast metal, and joining the two metals, the body with the covering, firmly and securely, or by a combination of these methods, leaving an intermediate portion of the covering free to be expanded by the action of the gases of the discharge passing through certain channels or passages between the covering and the body of the shot made or left for that purpose. Also, making the wrought iron covering thicker at its rear end, which admits annular spaces being cut into it to hold grease, or for the action of the atmosphere to keep the ball true in its flight, as in the improved ball for muskets, and also throws the bearing parts of the projectile nearer the centre of gravity, insuring greater accuracy."

139. For an *Improvement in Washing Machines;* Justin Loomis, De Ruyter, New York.

Claim.—"The tubular guide piece, forked brace joint, swivel pin, and socket, in combination with the braces and the rubber shaft."

140. For an *Improvement in Cupola Furnaces;* Philip W. Mackenzie, Jersey City, New Jersey.

Claim.—"Forming a continuous sheet of air as indicated, where it is brought in contact with the fuel, in combination with the elongated form and increased size below where the blast enters the fuel."

141. For an *Improvement in the Cutting Apparatus of Harvesters;* Pells Manny, Waddams' Grove, Illinois.

Claim.—"The method of constructing the fingers of the cutting apparatus of harvesting machines of two members, and securing them upon the finger bar. Also, the recesses in the inner faces of the fingers, in combination with the supplementary inclined cutters projecting above and below the sickle."

142. For an *Improvement in Ships' Capstans;* Charles E. Marwick, Portland, Me.

Claim.—"The combination of the key-ring, the recessed lip, and the socketed head, as constructed and arranged together, and applied to the capstan barrel and the driving shaft of the multiplying gearing."

143. For an *Improvement in Water Vessels for imparting Humidity to Hot Air, and Vapor Draft to the Grate Bars of Hot Air Furnaces;* Wm. Moultrie, City of New York.

Claim.—"The structure, location, and application of the water vessel, whereby either or both of said objects are attained in connexion with furnaces and other heating apparatus."

144. For an *Improvement in Cooking Ranges;* Samuel Pierce, Troy, New York.

Claim.—"The combination of the recess between the ovens, having a division plate therein open at the top with the bottom flue, so as by the action of the draft of said bottom flue, to cause a circulation in said recess."

145. For a *Photogalvanographic Process for Printing;* Paul Pretsch, Austria.

Claim.—"The peculiar adaptation of the photographic process to the production of metallic and other surfaces suitable for printing, and for various other useful and ornamental purposes."

146. For an *Improved Boring Machine;* Emmett Quinn, Trenton, New Jersey.

Claim.—"The combination of the sliding guide, with the levers and timber carriage."

147. For an *Improved Bending Machine;* Lewis Raymond, City of New York.

Claim.—"The combination of three rollers, convex and concave, so as to bend sheet metal transversely and longitudinally at one operation. Also, in combination with the above, I also claim a supporting roll."

148. For an *Improvement in Glass Furnaces;* Samuel Richards, Philadelphia, Pa.

Claim.—"The arrangement of the drying ovens, the flue, and the endless carrier, and the schutes, in combination with the glass furnace."

149. For an *Improved Ink-stand;* Thomas Robjohn, City of New York.

Claim.—"The arrangement for flexing the elastic diaphragm by so attaching a mechanism in connexion with a cover for the ink cup, that the opening and closing thereof shall effect the raising or discharge of the ink, or other fluid, into or from said cup."

150. For an *Improvement in Looms;* Edwin A. Scholfield, Westerly, R. I.

"The principle of my invention consists in drawing the cam-wheel which acts on the harness, not by a uniform motion, but by an intermittent and variable motion; its periods of intermission and change coinciding with those of the springing or changing of the harness."

Claim.—"The driving a revolving cam or tappet wheel which acts to spring the harness, or produce a shed, in weaving by an intermittent or variable motion by the use of star gears."

151. For an *Improvement in Washing Machines;* Isaac A. Sergeant, Springfield, Ohio.

Claim.—"1st, The employment within a water-tight tub of an adjustable rotating perforated platform or secondary tub. 2d, Providing the outer end of roller with a shoulder of larger diameter than the body of the roller."

152. For an *Improvement in the Packing of Rotary Steam Engines;* Gerard Sickles, Brooklyn, New York.

Claim.—"The application of loose metal rings to pack the revolving heads which carry the pistons to the stationary heads of the cylinders of rotary engines and pumps."

153. For an *Improved Fence for Poultry Yards;* William P. Thomas, Whitewater, Indiana.

Claim.—"The combination of the swinging frame with posts. Also, the swinging board, in combination with the swinging frame."

154. For an *Improvement in Vibrating Shears;* John Toulmin, New Worcester, Massachusetts.

"This invention consists in the manner of hanging the movable blade of a pair of shears, so that the position of said blade can be adjusted with the greatest accuracy, whereby the shears can be constantly kept in good cutting order."

Claim.—"Hanging the movable blade of a pair of shears by two adjustable centre pivots upon an adjustable pillar block, and for the purpose of so adjusting the movable blade of said shears as to give it the most effectual shearing position in relation to the stationary blade."

155. For an *Improved Method of Clamping Logs in Cross-cut Sawing Machines;* Stephen Woodard, New London, New Hampshire.

Claim.—"Holding the wood to be sawed by means of holders acted upon by the toggle joints weighted at their centres."

156. For an *Improvement in Washing Machines;* Abram Wood, Camden, N. York.

Claim.—"The hinging of the board so that the disk and its shaft may be conveniently raised out of the tub and thrown back while the clothes are handled, and again conveniently let down for the operation, and by which arrangement the whole machine including the bench may be lifted and moved from place to place."

157. For an *Improvement in Sewing Machines;* Wm. Wickersham, Boston, Mass.; patented in England December 29, 1854.

Claim.—"1st, A fast stitch made by one thread, which is formed by having the loop or double of the thread pass through from one side of the cloth to the other, and back again in another place to the first side of said cloth, and around the same thread of which the loop is formed by means of a shuttle carrying said thread through said loop. 2d, A thread guide with a notch or opening in one side of it to receive the thread, and formed so that the thread may pass into it, when said thread is to be guided into the eye or hook of the needle, and pass out of said notch in the thread guide at other

times. 3d, The use of a double hooked needle in taking the thread both ways through the cloth, one way or up through the cloth by means of one hook, and the other way or down through the cloth by means of the other hook of the same needle."

158. For an *Improvement in Sewing Machines;* Wm. Wickersham, Boston, Mass.; patented in England December 29, 1854.

Claim.—"1st, The method of taking up the slack thread above the cloth by means of the shuttle, that is, when the needle descends after having taken the thread up through the cloth, and to its greatest distance above said cloth, drawing down through the cloth the end of the thread connected with the shuttle by means of the shuttle receding from the needle, as the needle descends, thereby preventing the liability of the thread getting under the point of the needle as said needle passes down into the cloth, by thus keeping said thread straight or nearly so until said needle point is sufficiently near said cloth that there is no further liability of the thread raising under it. 2d, The formation of a seam of one thread which cannot be unraveled, of stitches each of which is made by having the loop or double of the thread passed through from one side to the other of the cloth, and back again in another place to the first side of said cloth, and a loop formed by means of a hook needle, and then by having the same thread of which said loop is formed, passed through said loop, and the loop drawn up to the cloth around the thread thus passed through it by means of the shuttle."

159. For an *Improvement in Automatic Rakes for Harvesters;* John W. Brokaw, Assignor to Warder, Brokaw & Child, Springfield, Ohio.

Claim.—"The arrangement of the spring guide and double guide bar, in combination with the rake head and carrying friction rolls. Also, the friction rolls, in combination with the sleeve rake head and guide rod."

160. For an *Improvement in Sewing Machines;* Henry Behn, Assignor to self and Thomas Sewell, City of New York.

Claim.—"The specific looping device consisting of two pointed bars, the one moving in a plane above the plane of motion of the other, and operating in combination with the needle in such manner, that the loop is formed and held open by bending the thread out of a straight line in opposite directions."

161. For an *Improvement in Sewing Machines;* Samuel Larkin, Assignor to Wheeler & Wilson Manufacturing Co, Bridgeport, Connecticut.

Claim.—"A spring forceps, in combination with a spindle, or equivalent means of supporting the spool."

162. For an *Improvement in Cultivators;* Charles H. Sayre, Utica, Assignor to self and Samuel Remington, Ilion, New York.

Claim.—"A combined horse hoe, and double mould board plough."

163. For an *Improvement in Boot Crimps;* Wm. W. Willmott, Assignor to self, Amos H. and Charles H. Brainard, Boston, Massachusetts.

Claim.—"1st, The device for operating the pincers, consisting essentially of the block, the screw, the spring, ratchet, and pawl. 2d, The device for the purpose of securing the jaws to the stand, consisting essentially of the slit, with its shoulders, and the tenon, with its shoulders."

164. For an *Improved Machine for Folding Paper;* C. P. Wiggins, A. H. Nordyke, and Benjamin Strawbridge, Richmond, Indiana.

Claim.—"1st, The combination of the cam-wheel, with lever, pinion, shaft, drum, cords and blade. 2d, The combination of the cam-wheel with levers, pinions, shafts, and drums, for the purpose of producing an alternate movement of the blades. 3d, The combination of jaws or clamps and lever, with blade to prevent retraction of the paper."

Additional Improvement.

1. For an *Improvement in Hoisting Winches for Ship-board;* Joel Bryant, Brooklyn, New York; patented April 7, 1857; additional dated August 11, 1857.

Claim.—"The invention and use of winches (or compound winches) for hoisting.'

RE-ISSUES.

1. For an *Improved Method of Making Wire Strengthened Spoons;* Charles Parker, Meriden, Assignor to Wm. Mix, Prospect, Connecticut; patented May 1, 1849; re-issued August 4, 1857.

Claim.—"Casting the spoon handle in a mould of larger dimension than the finished handle is required to be, and subsequently swaging the handle into the proper shape, and condensing the metal upon the strengthening wire by means of the drop press and die."

2. For an *Improvement in Distributing Apparatus for Flouring Mills;* Alfred T. Clark, Lancaster, Pennsylvania; patented June 30, 1857; re-issued August 4, 1857.

Claim.—"The double series of spouts and valves, arranged and connected with the bolting chamber. Also, the arrangement of the conveyor, in combination with a double series of valves and spouts."

3. For an *Improvement in Rice Hullers;* Peter McKinlay, Charleston, South Carolina; patented April 1, 1851; re-issued August 11, 1857.

Claim.—"Operating the pestle by having it attached to a rod passing through the bottom of the mortar, and receiving motion through a crank, or its equivalent."

4. For an *Improvement in Boot Crimps;* J. M. Read, Boston, Assignee (through Abraham Thayer) of Josiah Copeland, Weymouth, Mass.; patented January 20, 1844; re-issued August 11, 1857.

Claim.—"Arranging the block and clasps, so that the turning up of the straining screw shall at the same time perform the double operation of confining the ends of the leather between the block and clasp, and of stretching the leather over the boot form."

5. For an *Improvement in Reed Musical Instruments;* Jeremiah Carhart, City of New York; patented December 28, 1846; re-issued June 24, 1856; re-re-issued August 18, 1857.

Claim.—"So connecting the board which contains the reed seats or perforations for the reeds with the exhausting bellows, that it shall form substantially a part of the stationary leaf or cover of the exhaust chamber thereof, while the exhausting or pumping chamber is placed in immediate connexion with the said exhaust chamber without the intervention of tubes, thus improving the tone of the reeds, expediting their speaking, and giving a compact, light, convenient, and graceful form to the instrument. Also, the reed cells, in combination with the reed seats or openings. Also, the concentrating chamber, in combination with the reed cells and reed seats. The last two combinations only when they are to be used with a suction or exhaust bellows, capable of producing a continuous current of air through the reed."

6. For an *Improvement in Gloss Journal Box;* Edward Campbell, Columbus, Ohio; patented August 21, 1855; re-issued August 25, 1857.

Claim.—"A journal box composed of a metal shell or body, and anti-friction lining surface of vitreous material, when said vitreous material is combined with its metal back."

7. For an *Improved Automatic Regulator for Wind-Wheels;* Joseph Dunkley, Carrollton, Missouri; patented January 30, 1857; re-issued August 25, 1857.

Claim.—"1st, The combination and arrangement of the air passages, with the peculiar devices, for the purpose of making a self-regulating wind-wheel. 2d, The swinging wing and slide. 3d, The peculiar arrangement of slats, cord and weight."

8. For an *Improvement in Ovens;* Wm. E. Treadwell and Wm. Hustace, Executors of E. Treadwell, dec'd., City of New York; patented July 19, 1853; re-issued August 25, 1857.

Claim.—"1st, The combination of flues and furnaces with an endless apron, or its equivalent, whereby the amount of heat imparted to either side of an apron or chain may be regulated independently. 2d, In combination with an endless apron and oven, or their equivalents, discharging and charging apertures, located in such manner that dough may be charged and withdrawn in lines perpendicular or nearly so to the line of motion of an endless apron."

9. For an *Improvement in Capstans for Steamboats;* John Schaffer, West Manchester, Pennsylvania; patented October 21, 1856; re-issued August 25, 1857.

Claim.—"The drum on the shaft of the capstan, as arranged, the capstan being steam driven by geared shafting connecting it with the 'little nigger,' and the whele being combined and made operative through the pulley."

DESIGNS.

1. For *Statues of General Warren;* Henry Dexter, Cambridge, Assignor to William Carleton, Charlestown, Massachusetts.

Claim.—"The photographs represent a statue of General Warren, of full length, with military boots and military frock coat, the vest buttoned up at the throat, with the left foot slightly advanced, the left hand in a position crossing the body, the right hand resting on the hilt of a sword, the point of which rests on a pedestal. The figure is represented without a hat, with the hair curled at the sides of the head."

2. For *Stoves;* J. J. Dulley and Russell Mann, Troy, Assignors to George W. Eddy, Waterford, New York.

3. For *Stoves;* S. W. Gibbs, Assignor to Young & Brother, Albany, New York.

4. For *Cooking Stoves;* Elias Young, Cincinnati, Ohio.

5. For *Stoves;*
6. For *Stoves;*
7. For *Stoves;*
8. For *Stoves;*
9. For *Stoves;*
10. For *Stoves;* } Thomas Barry, City of New York; dated August 25, 1857.

11. For *Stoves;*
12. For *Stoves;*
13. For *Stoves;*
14. For *Stoves;*
15. For *Stoves;*
16. For *Stoves;* } Samuel H. Ransom, Albany, New York; dated August 25, 1857.

17. For *Clock Case Fronts;* Pietro Cinquinni, West Meriden, Connecticut; dated August 25, 1857.

18. For *Brick;* G. W. Sholl and Charles Stewart, Cincinnati, Ohio; dated August 25, 1857.

19. For *Stoves;* Thomas D. Worrall, Lowell, Mass.; dated August 25, 1857.

The claims on the above are for the several shapes, forms, and ornaments.

SEPTEMBER 1.

1. For an *Improvement in Machines for Cutting Corn Stubble, &c., on Ground preparatory to Ploughing;* John Augspurger, Trenton, Ohio.

Claim.—"The combination with the teeth of a rake, of rotating knives."

2. For an *Improvement in Thills for Two-wheeled Vehicles;* Philip Baillau, City of New York.

Claim.—"The flat spring, or its equivalent, at the back end of the thills."

3. For an *Improvement in Sealing Cans;* Edwin Bennett, Baltimore, Maryland.

Claim.—"The construction of a cap formed with a flaring lip-like rim, and groove or gutter, and combined with a stopper part, arranged and applied to an inverted jar or other receptacle."

4. For an *Improvement in Rakes;* Andrew J. Bledgett, Newport, New Hampshire.

Claim.—"Making each arched brace rod and one or two teeth in one piece of wire, and extending the same through the rake head, and into or through the handle."

5. For an *Improved Machine for Wiring Blind Rods;* Byron Beardman, Norwich, Connecticut.

"My invention consists in the employment or use of two feeding devices, one of which feeds the staples between the guides which conducts the staples to the rod, and the other feeds the rod along underneath the guides to receive the staples, so that they may

be driven into the rod at equal distances apart—the above parts being used in connexion with a driving device for forcing the staples into the rod—and the whole so arranged as to operate automatically and in a perfect and expeditious manner."

Claim.—"The means employed for feeding the staples between the guides and underneath the die or rod, that is to say, the plate, pivoted to the plate on which the staples are placed, and provided with the shoulders, the plate being connected with the bar by means of the rod. Also, feeding the rod underneath the guides to receive the staples by means of the bar attached to the bent lever in connexion with the lever, said parts being operated by their respective springs, and also by the bar. Further, the guides to convey the staples to the rod, and at the same time also allow to expand, so as to prevent the clogging of the same, in combination with the die or rod for driving the staples into the rod."

6. For an *Improved Machine for Spooling Thread;* Charles K. Bradford, Lynn, Mass.

"This invention is to enable a person to wind thread expeditiously, upon a small bobbin or spool; such for instance as may be used in an ordinary sewing machine."

Claim.—"The improved mode of regulating the winding of the thread, that is, by causing the thread carrier to rest directly against, and be moved and guided in its movements by, the side of the helix coil on the bobbin."

7. For an *Improvement in Coal Sifters;* Wm. D. Brown, Weymouth, Mass.

Claim.—"The combination of the screen and the plates placed in a vessel or machine to be used as a portable coal hod and sifter, so suspended on an axis as to allow of an oscillating or swinging movement."

8. For an *Improvement in Seeding Machines;* Charles W. Cahoon, Brooklyn, New York.

"This invention consists in the novel means employed for discharging broad cast the seed or fertilizing material, whereby the work is done in a perfect manner."

Claim.—"The disk and rock shaft, with its teeth, in combination with the funnel-shaped discharger having spiral flanches."

9. For an *Improvement in Straw Cutters;* Aury G. Coes, Worcester, Mass.

Claim.—"My improved straw cutting machine, so that its bed and knife shall operate with a compound motion produced by a lever crank, fulcrum rod and guides, arranged so as to operate together."

10. For an *Improved Ore Separator;* Thomas J. Chubb, City of New York.

Claim.—"1st, The employment in combination with an inclined perforated table or bed and a bellows, of a number of channels applied and arranged relatively to the bed and to each other, to convey away the separated substances in different directions. 2d, The division of a bellows, applied and operating in connexion with a perforated bed for the separation of articles of different specific gravity into numerous chambers or compartments, each having its separate valve or valves, and constituting in itself a complete bellows."

11. For an *Improvement in Machines for Washing Bottles;* Henry N. Degraw, Watervleit, New York.

Claim.—"The expanding brush, formed of the brush bars connected to the rod and bar, and expanded and contracted by the lever and spring, when said brush thus arranged and operated is used in connexion with the sliding holder."

12. For an *Improved Machine for Swedging Hatchet Heads;* Levi Dodge, Cohoes, New York.

Claim.—"The apparatus, viz: the block cheeks and former."

13. For an *Improved Machine for Sawing Staves;* Peter Deal, Amsterdam, and James Greenman, Northampton, New York.

"Our improvements relate to that class of machines for sawing staves, in which a cylindrical saw is used to sever the staves from the stock."

Claim.—"1st, The combined method of supporting and driving cylindrical saws from their periphery. 2d, The arrangement on the interior of a cylindrical saw of a supporting table, and an adjustable gauge or guide, by which the thickness of the stave is gauged, and it is guided during its passage through the saws, and one stave is prevented from passing each other, and jamming against and stopping the saws, or throw-

ing the front stave off the side of the table on the bottom of the saws. 3d, The arrangement of a guard plate on the interior of a cylindrical saw, for the purpose of preventing the saw-dust chips being thrown into the kerf of the stave. 4th, The method of diminishing the pressure of the curved surface of the stock against the periphery of a cylindrical saw, by pivoting the track on which the carriage holding the stock traverses, so that the pressure of the forward end of the stock will throw the track outward, and thus prevent the saw from binding in the kerf."

14. For an *Improved Saw Clamp;* Leonard O. Fairbanks, Bridgeton, Maine.

Claim.—"My improved saw clamp as made with its jaws, clamping device, adjusting screws, and bed plate. Also, making the stationary jaw with a groove arranged in it, in manner and so as to operate with the movable jaws, when constructed and made to act with respect to the stationary jaw and bed plate."

15. For an *Improvement in Life Preserving Berths for Steam and other Vessels;* Elbridge Foster, Hartford, Connecticut.

"This invention consists in the construction of movable and adjustable berths, with inflated elastic keels, to be used as a life preserver on steam and other vessels."

Claim.—"The adjustable inflated keels."

16. For an *Improved Device for Locking Faucets;* Henry Getty, Brooklyn, New York.

"This invention relates to an improvement in that class of faucets in which a spring is employed, in connexion with static pressure for keeping the valve closed."

Claim.—"In combination, the L shaped grooves at the upper part of the spring barrel, stop bar, and the secret stop arm, placed loosely over the valve stem, and attached to screw collar, whereby facilities are offered for fastening the faucet closed, and also when necessary, of placing it beyond the control of servants, and others not entrusted with its management."

17. For an *Improvement in Animal Traps;* George Hart, Granger, Ohio.

Claim.—"The arms, springs, and ring."

18. For an *Improved Method of Operating the Cutters of Harvesting Machines;* James Haviland, Milton, New York.

Claim.—"Imparting the requisite movements to the cutter blade of a harvesting machine, by means of the spirally grooved intermediate shaft, and the series of hemispherical or oval headed teeth, projecting from the face of the main bearing wheel, and operating upon the said intermediate shaft."

19. For an *Improvement in Spirit Stills;* Edward Herring, Walton on Thames, England.

"The nature of my invention consists in certain improvements in stills, whereby their evaporating power is increased, the movement of the wash facilitated, and the cleansing of the still rendered easier and more perfect; said improvements being specially intended to adapt to the requirements of American distilling, in which a thick and heavy wash is employed, the best distillatory apparatus used in Europe."

Claim.—"1st, Giving to the diaphragms which separate the chambers, an inclination or fall towards alternate sides of the still. 2d, The introduction of hot air for the purpose of aiding in the evaporation of the wash, and keeping it in agitation to prevent the clogging of the still."

20. For an *Improvement in Surf and Life Boats;* Richard C. Holmes, Cape May Court House, New Jersey.

Claim.—"Constructing a boat of the peculiar form, and giving to a boat of that form buoyant ends, a ballasting tank, and freeing valves."

21. For an *Improved Raking Device for Harvesters;* Stephen R. Hunter, Cortlandt, New York.

"My invention consists in the employment or use of two gates applied to the machine, whereby the cut grain is deposited upon the ground in sheaves or gavels."

Claim.—"The rod, or its equivalent, and two gates applied to the machine, the gates being operated from the wheel by means of the cam, crank shaft, rod and arm."

22. For an *Improved Hub for Carriage Wheels;* James W. Jackson and Luther W. Burchinal, Smithfield, Pennsylvania.

Claim.—"Making the mortises of the hub adjustable in two different directions, so

that the spokes of the wheel shall be grasped on their four sides simultaneously when the two plates of the hub are forced together by the screw-bolts."

23. For an *Improved Feed and Gigging Movement for Sawing Mills;* George D. Lund, Yonkers, New York.

Claim.—"The combination of the two cones, the conical hub or boss and pinion on the sleeve or collar, placed on the sliding shaft of the cone, and the gearing."

24. For an *Improvement in Sack Fastener;* Wm. P. and Jacob E. B. Maxson, Albion, Wisconsin.

Claim.—"A bag or sack fastener consisting of a spring tongue pressing the string against a side flanch or projection, so as to form a self-holding nipper clutch, when the said sack fastener is made of a single piece of metal cut and bent."

25. For an *Improvement in Chimney Caps;* Ira Mayhew, Albion, Michigan.

Claim.—"The constant openings immediately beneath the drip of the roof, in combination with the larger variable openings, which are furnished with valves, hung at points and separated by the connecting rods below."

26. For an *Improvement in Shower Bath Apparatus;* William Meyer, Progress, New Jersey.

Claim.—"The lower rose, by means of which water can be thrown upwards, and a more perfect and thorough shower bath is obtained."

MECHANICS, PHYSICS, AND CHEMISTRY.

*On the Chemical Changes which Pig Iron undergoes during its conversion into Wrought Iron.** By F. Crace Calvert, F.C.S., and M.R.A., of Turin, and Richard Johnson, Esq.

Wishing to make some improvements in the manufacture of iron, we carefully examined the various analyses which had been made of pig iron and wrought iron; but we found that no comparison could be made between the recorded results, as the samples analyzed had been obtained from different sources, and also as no detailed analysis had been published of the various chemical changes which pig iron undergoes in the process of puddling during its conversion into wrought iron. We therefore decided to undertake this task, with the hope of throwing some light upon this important operation in the manufacture of iron, and of thereby enabling practical men to make those improvements in the puddling of iron which on many accounts are so much to be desired.

To fully investigate and closely follow the progressive and interesting chemical changes which pig iron undergoes during its conversion into wrought iron, we took samples every five or ten minutes after the pig iron had melted in the furnace. These chemical actions are clearly defined in the furnace by the peculiar appearance which the mass assumes as the operation proceeds.

It is necessary that we should describe in a rapid manner the physical conditions which pig iron assumes during its conversion into wrought iron. When first heated in a puddling furnace, it forms a thick, pasty mass, which gradually becomes thin, and as fluid as mercury. When it has reached this point it experiences a violent agitation, technically called "the boil," which is produced no doubt by the oxidation of the

* From the Lond., Edin., and Dublin Philo. Mag., Sept., 1857.

carbon, and the escape of the carbonic oxide then generated. During this period of the operation the mass swells to several times its primitive bulk, and the puddler quickly agitates the melted mass to facilitate the oxidation of the carbon. After a short time the mass gradually subsides; the puddler then changes his tool, and takes the "puddle" to gather with it the granules of malleable iron floating in the melted mass of scoria or slag. The granules or globules of iron gradually weld together and separate from the scoria; and this separation is hastened by the puddler gradually forming large masses, called balls, weighing about 80 lbs., from which the scoria drains out. This part of the operation requires great skill in the puddler; for nearly the whole of the carbon has been oxidized, so that if the current of air is not managed with great care, the iron itself is oxidized, or as it is technically termed, "burnt;" and thus not only does great loss ensue in the quantity of malleable iron produced, but also the iron containing a certain quantity of oxide of iron is brittle, and of bad quality.

We shall now examine the various chemical changes which pig iron undergoes during its conversion into wrought iron.

The iron we took for our experiments was a good cold-blast Staffordshire iron; the pig was rather gray, being of the quality used for making iron wire, or a gray No. 3. Its composition was as follows:

	First analysis.	Second analysis.	Mean.
Carbon,	2·320	2·230	2·275
Silicium,	2·770	2·670	2·720
Phosphorus,	0·580	0·710	0·645
Sulphur,	0·318	0·288	0·301
Manganese and aluminium,	traces.	traces.	
Iron,	94·059	94·059	94·059
	100·047	99·957	100·000

224 lbs. of the above pig iron were introduced at 12 o'clock, on the 4th of April, 1856, into a puddling furnace which had been cleaned out with malleable iron scraps. After thirty minutes the pigs began to soften and to be easily crumbled, and ten minutes more had hardly elapsed when they entered into a state of fusion. The first sample was taken out of the furnace at 12h 40m P.M., from the centre of the melted mass with a large iron ladle and poured on a stone flag to cool. The flue of the furnace, which up to this time had been kept open, was now nearly closed by a damper at the top of the chimney, so that the products of combustion came out by the door of the furnace and other openings, whilst little or none escaped by the chimney.

Appearance of the Sample.

On breaking the sample as taken out of the furnace, it had no longer the appearance of gray No. 3 pig iron, but a white, silvery, metallic fracture, similar to that of refined metal. The rapid cooling of the sample was no doubt the cause of the change noticed, for it contained

quite as much carbon as the pig iron used; and further, the carbon was in a very similar condition, as in both cases a large quantity of black flakes of carbon floated in the acid liquors in which the iron was dissolved. The following is the amount of carbon and silicium which the above sample contained per cent.:—

	First analysis.	Second analysis.	Mean.
Carbon, . .	2·673	2·780	2·726
Silicium, . . .	0.893	0·938	0·915

These results are highly interesting, as they show that the iron had undergone during the forty minutes which it had been in the furnace, two opposite chemical changes; for whilst the proportion of carbon had increased, the quantity of silicium had rapidly decreased. This curious fact is still further brought out by the sample which we took out of the furnace at 1 P.M., or twenty minutes later than the last sample analyzed, as is shown in this Table:—

	Carbon.	Silicium.
Pig iron used, ...	2·275	2·720
1st sample taken out at 12h 40m, .	2·726	0·915
2d " " 1h 0m, .	2·905	0·197

Therefore the carbon had increased 0·625, or 21·5 per cent. of its own weight, and the silicium had decreased in the enormous proportion of above 90 per cent. It is probable that these opposite chemical actions are due, in the case of the carbon, to the excess of this element in a great state of division or in a nascent state in the furnace, and that under the influence of the high temperature it combines with the iron, for which it has a great affinity, whilst the silicium and a small portion of iron are oxidized and combined together to form protosilicate of iron, of which the scoria or slag produced during this first stage of puddling consists, and which plays such an important part in the remaining phenomena of the puddling process.

2d Sample, taken out of the furnace at 1h 0m P.M.

This sample contained the following quantities of carbon and silicium:—

	First analysis.	Second analysis.	Mean.
Carbon, . .	2·910	2·900	2·905
Silicium, . . .	0·226	0·168	0·197

It had the same white, silvery appearance as No. 1; but had this difference, that it was slightly malleable under the hammer, instead of being brittle like No. 1. The scoria also was on the upper surface of the mass when cold, and not mixed with the metallic iron, as in succeeding examples.

3d Sample, taken out at 1h 5m P.M.

The mass in the furnace having become very fluid, and beginning to swell or enter into the state called "the boil," a small quantity was ladled out. When cold it was quite different from that of the two previous ones, being composed of small globules adhering to each other, and mixed with the scoria; the mass therefore was not compact, like

the former ones, but was light and spongy; its external appearance was black, and the small globules when broken presented a bright metallic lustre, and were very brittle under the hammer. We had for some time considerable difficulty in separating the scoria from the globules of iron; but we found that by pulverizing the whole for a long time, the scoria was reduced to impalpable powder, and by sieving we could separate it from the iron, which was much less friable. The iron thus cleansed from its scoria gave us the following results:—

	First analysis.	Second analysis.	Mean.
Carbon, . . .	2·466	2·421	2·444
Silicium, ...	0·188	0·200	0·194

4th Sample, taken out at 1h 20m P.M.

As soon as the last sample had been taken out, the damper of the furnace was slightly raised so as to admit a gentle current of air, which did away with the smoke which had been issuing from the puddler's door, and a clear and bright flame was the result. This was done, no doubt, to facilitate the oxidation of the carbon of the iron, and to increase this action the puddler quickly agitated the mass. Under these two actions the mass swelled up rapidly, and increased to at least four or five times its original bulk; and at 1h 20m, the mass being in full boil, this 4th sample was taken out. Whilst cooling, it presented the interesting fact, that in various parts of it small blue flames of oxide of carbon were perceived, no doubt arising from the combustion of carbon by the oxygen of the atmosphere. It is curious that this phenomenon was not observed in the previous samples. It is due probably to the following causes: first, that the cast iron, having been brought by the boil to a state of minute division, offers a large surface to the action of the oxygen of the air, and thus the combination of the oxygen with the carbon of the iron is facilitated: and second, that at this period the carbon seems to possess little or no affinity for the iron; for one of us has often observed that when pig iron, rich in graphite, is puddled, the carbon is liberated from the iron; for if a cold iron rod is plunged into the mass of melted iron in the puddling furnace, it is covered with iron and abundant shining scales of graphite carbon.

The appearance of this No. 4 sample was most interesting; and the best idea that we can give of it is, that it is so light and formed of such minute granules as to be exactly like an ant's nest. The particles have no adherence to each other, for by mere handling of the mass it falls into pieces. This is due to each particle of iron being intimately mixed with scoria. The granules of iron have a black external appearance, are very brittle under the hammer, and when broken they present a bright, silvery, metallic fracture. The scoria was separated by the method above described for No. 3, and the quantities of carbon and silicium which the iron contained were as follows:—

	First analysis.	Second analysis.	Mean.
Carbon, . . .	2·335	2·276	2·305
Silicium, ...	0·187	0·178	0·182

5th Sample, taken out at 1h 35m P.M.

This sample is a most important one in the series, as it is the first in

which the iron is malleable and flattens when hammered. It was ladled out of the furnace just as the boil was completed, and the swollen mass began to subside. The damper at the top of the chimney was drawn up, so that a very rapid draft was established through the furnace. The puddler also changed his tool, leaving the rubble and taking the puddle to work with. When cold it partakes of the appearance of Nos. 3 and 4 samples, the mass being spongy and brittle, as in No. 4, but less granulated, and like No. 3, being in separate globules, mixed with the scoria. The granules are black externally, but are bright and metallic when flattened. The analysis of these globules proves that the mass of iron in the furnace has lost during the quarter of an hour which has elapsed since the taking of No. 4 sample, a large proportion of its carbon, equal to 20 per cent. of its weight, whilst the silicium, on the contrary, has remained nearly stationary.

	First analysis.	Second analysis.	Mean.
Carbon, . .	1·614	1·681	1·647
Silicium, . . .	0·188	0·178	0·185

6th Sample, taken out at 1h 40m P.M.

The reason why this sample was taken only five minutes after the last sample, was, that the mass in the furnace was rapidly transforming itself into two distinct products, viz: the scoria on the one hand, and small globules of malleable iron on the other. We attached some importance to this sample, as the workman was on the point of beginning the balling or agglomerating the globules of iron, so as to form large balls of about 80 lbs. weight, to be hammered and rolled out into bars. Whilst the mass taken out for analysis was cooling, small blue flames of oxide of carbon issued from it. These were similar to those observed in Nos. 4 and 5, but were not so abundant. The appearance of this sample was very similar to the last one, with the exception that the scoria was not so intimately mixed with the globules of iron, and that these were larger, and slightly welded together when hammered. The proportions of carbon and silicium were as follows:—

	First analysis.	Second analysis.	Mean.
Carbon, . .	1·253	1·160	1·206
Silicium, . . .	0·167	0·160	0·163

When these figures are compared with those of the previous analysis, it is interesting to observe, that whilst the silicium remains nearly stationary, the carbon rapidly diminishes; for in the five minutes which elapsed between the taking out of the two samples, there was 28 per cent. of the carbon burnt out. This rapid decrease of carbon in the iron is maintained during the remaining ten minutes of puddling. In fact, in one quarter of an hour, viz: from 1h 35m to 1h 50m, the iron lost 50 per cent. of the carbon which it contained at 1h 35m.

7th Sample, taken out at 1h 45m P.M.

This sample was obtained when the puddler had began to ball. The appearance of the sample, although similar to the last, differs from it by the granules being rather larger, and nearly separated from the scoria, which forms a layer at the top and bottom of the mass. These granules

are also much more malleable, for they are easily flattened under the hammer. This last fact is easily accounted for by the small amount of carbon which it contains, as stated above and shown by these results:—

	First analysis.	Second analysis.	Mean.
Carbon,	1·000	0·927	0·963
Silicium,	0·160	0·167	0·163

8th Sample, taken out at 1h 50m P.M.

This last sample was taken a few minutes before the balls were ready to be removed from the furnace, to be placed under the hammer, and was a part of one of the balls which were separated and placed to cool. It was observed that no blue flame issued from the mass as it cooled. The appearance of the sample showed that the mass constituting the ball was still spongy, and granulated similar to the previous ones. The only difference was, that the granules adhered together sufficiently to require a certain amount of force to separate one from the other, and also that they were much more malleable under the hammer. They were found to contain the following quantities of carbon and silicium per cent. :—

	First analysis.	Second analysis.	Mean.
Carbon,	0·771	0·773	0·772
Silicium,	0·170	0·167	0·168

We should observe here, that the black coating which covers the granules of iron, even of No. 8 sample, preserves the iron from all oxidation; for none of the samples became oxidized during the nine months they were in the laboratory, exposed to the atmosphere, and to the various acid fumes floating about. This black coating is probably composed of a saline oxide of iron.

9th Sample.—Puddled Bar.

The balls taken out of the furnace were hammered, and then rolled into bars, and in these we found the following :—

	First analysis.	Second analysis.	Mean.
Carbon,	0·291	0·301	0·296
Silicium,	0·130	0·110	0·120
Sulphur,	0·142	0·126	0·134
Phosphorus,	0·139		0·139

10th Sample.—Wire Iron.

The puddled bars were cut into billets of about 4 feet in length, and heated in a furnace to a white heat, and then rolled into wire iron. The proportion of carbon, silicium, sulphur, and phosphorus, were as follows :—

	First analysis.	Second analysis.	Mean.
Carbon,	0·100	0·122	0·111
Silicium,	0·095	0·082	0.088
Sulphur,	0·093	0·096	0·094
Phosphorus,	0·117		0·117

To complete the series of products in the conversion of pig iron into

wrought iron, we analyzed the scoria or slag which remained in the furnace after the balls had been taken out, and found its composition to be as follows:

Silica,	16·53
Protoxide of iron,	66·23
Sulphuret of iron,	6·80
Phosphoric acid,	3·80
Protoxide of manganese,	4·90
Alumina,	1·04
Lime,	0·70
	100·00

Therefore in the scoria are found the silicium, phosphorus, sulphur and manganese which existed in the pig iron; and probably the phosphorus and silicium are removed from the iron by their forming fusible compounds with its oxide.

We shall conclude this paper by giving our results in a tabulated form, so that the removal of the carbon and silicium may be better appreciated by those who may consult it with the view of obtaining such information as may lead them to those improvements to which we think our investigations tend.

Pig iron used.	Time.	Carbon.	Silicium.
		2·275	2·720
Sample No. 1	12·40	2·726	0·915
" " 2	1·0	2·905	0·197
" " 3	1·5	2·444	0·194
" " 4	1·20	2·305	0·182
" " 5	1·35	1·647	0·183
" " 6	1·40	1·206	0·163
" " 7	1·45	0·963	0·163
" " 8	1·50	0·772	0·168
Puddled bar, 9		0·296	0·120
Wire iron, 10		0·111	0·088

Finally, we wish to express to Mr. Siméon Stoikowitsch our best thanks for the ability and perseverance which he has shown in helping us in these long and tedious analyses.

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*The American Breech-Loading Guns.**

Mr. Eastman's six breech-loading cannon, recently imported from America, were yesterday tried on the Arsenal Wharf, Woolwich, under the supervision of Lieutenant-Colonel Wilmot, Superintendent of Government gun factories at Woolwich, and having been twice fired with a double charge of blank cartridge—namely, 20 lbs. of powder—they were examined, and found to have stood the test satisfactorily. From their enormous weight—17 tons—they did not evince the slightest recoil.

*From the Lond. Mech. Mag., Aug., 1857.

Specification of a Patent granted to PHILIPPE PIERRE HOFFMAN, *for an improved compound to be used for water-proofing fabrics, paper, leather, or other materials.**—[Dated 16th August, 1856.]

This invention consists in the manufacture of coatings impervious to water, and also to air, which may be used for coating fabrics and materials of various sorts, as water-proof awnings or coverings, and may also be applied to leather, paper or paste-board, as a varnish or water-proof coating or paint. Coatings of the compounds hereinafter described are very elastic, supple, and little affected by atmospheric influences, and do not warp, break, or become sticky, but keep dry under all variations of temperature of the atmosphere.

These coatings consist of either a mixture of siccative linseed oil and sulphur, called balm of sulphur, or of a mixture of the said balm of sulphur with a quantity of siccative oil, gum copal, gum opal, gallipot, yellow amber, resin, litsphalt, india rubber, and gutta percha, and with the essences of turpentine or naphtha, &c., these two latter keeping in solution the abovenamed substances, which may be mixed separately or at the same time with the balm of sulphur.

The chief features of the invention consist in the use of the balm of sulphur for rendering fabrics of all descriptions air and water-proof, and in preparing the balm, which, being obtained by the process hereinafter described, contains less sulphur, and has a less offensive smell than ordinary balm of sulphur, yet, at the same time, preserving all the requisite properties. The balm of sulphur is prepared in the following manner:—When the siccative oil has boiled for about two hours, in order to thicken it and separate its mucilaginous parts, which coagulate, it is left a few days to settle previous to decantation: then ten parts, by weight, are taken and submitted to slow boiling, during which small quantities of flowers of sulphur are added, and agitation is kept up the whole time. When from one to two parts of flowers of sulphur have been thus thrown in small quantities into the oily mixture, a transformation soon takes place, and the balm of sulphur now assumes a homogeneous mass of a brownish color, cohesive and elastic, somewhat like india rubber. The constituents of this composition or coating are then the following (by weight):—Ten parts of siccative thickened linseed oil, and from one to two parts of sulphur in powder; in addition to which one part of mixture A, may be added. The mixture A, is separately compounded, as hereinafter described, with oil and resin or gum. If it happens that by too great a heat, and in consequence of the sulphur being thrown in at too short intervals, a quick ebullition ensues, and a mass, almost inelastic, is obtained (which would not answer the desired purpose), to render this useful, it will suffice to submit the material to the action of a second boiling, in a closed vessel, for about two hours, with a properly-managed fire; when the whole will return again to the liquid state, and in such state may be used.

The following is another improvement or manipulation in preparing the balm of sulphur:—A certain quantity of siccative oil is boiled till it has acquired a thickened consistency; balm of sulphur is then added, containing from one-tenth to one-fourth of sulphur, according to the

* From Newton's Lond. Journ., May, 1857.

greater or less quantity of sulphur it is desired that the result should contain. Mixture is effected by the fusion of the two substances together.

The composition of the second coating may consist of the following materials and proportions (by weight):—Forty parts of siccative linseed oil, thickened with seven and a half parts of sulphur in powder; five parts of siccative linseed oil, which, in addition to the boiling, may be further thickened by one part of the mixture A, hereinafter described.

Instead of the flowers of sulphur, as designed for the preparation of the balm of sulphur, roll sulphur, sulphurate of carbon, or chloride of sulphur, may be used.

In preparing the balm of sulphur, as last hereinbefore described, the component parts given are separately treated, which are used and their proportions regulated according to the ultimate purpose for which the coatings are required.

The balm of sulphur, thus prepared, is used as the coating, and liquified either by the action of heat or by means of solvents; such as essence of turpentine, naphtha, &c. When it is desired to obtain a harder coating, gallipot gum, yellow amber, and resin, litsphalt, &c., may be added.

These substances are all to be added one by one; instead of so adding them, a separate mixture, denominated mixture A, may be used.

Mixture A, is prepared in the following manner:—Take, by weight, six parts of siccative linseed oil, thicken it by boiling two hours on the fire, and mix it with four parts of gum or resin. Then melt these substances, and mix with the oil when they are in ebullition.

The mixture of the materials is effected as is usually done for preparing varnishes, the gum or resin and the balm being melted separately, and afterwards mixed together. A solution of india rubber or gutta purcha will increase the adhesiveness of the compound.

These various coatings prepared in the manner described, may be applied in various ways on the fabric or other material or article to be coated. The fabric to be coated is dipped into the material when hot and in the liquid state, from which it is withdrawn and made to pass between six scrapers or cutters adjusted transversly above the vessel; so that any excess of the material is removed by the scrapers or knives, and drops into the vessel again.

The patentee claims, "the methods of preparing, and the preparations of balm of sulphur, as hereinbefore described; to be used as a waterproof coating, separately or in combination with other substances, as hereinbefore set forth."

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*A New Process for the Manufacture of Artificial Marbles.**

An Italian Correspondent sends us some notes on a new process for the manufacture of artificial marbles, invented by the Marchesi Campana. He says, "The Fabri is at San Giovanni, *en route* to Portici. In a large chamber, I found specimens of various species of the marble worked into tables, vases, pedestals, and cornices. Porphyry, rosso antico, giallo antico, brocatello, and other marbles, were there, so the eye declared; and neither myself nor my friends could have distinguished

* From the Lond. Athenæum, June, 1857.

between them and the real marbles. They were marked by the same 'ring' on striking them, by the same appearance in the internal formation, and by the same high polish on the surface. In fact, we were witnesses of the mode of polishing adopted, which resembled exactly that used for marbles, that is to say, pumice-stone and water in the first instance, and a hard, cross-grained stone, here called 'lavagna,' after. Adjoining the fabric, we were shown the roof of a house which had been covered with this material, and had resisted the heat of two summers and the cold and frost of two winters; yet not the slightest impression had been made by either. On the terrace surrounding the house were some loose bits of the marble plaster which had been thrown there, and which, on being examined, presented a flakey appearance, sparkled as fragments of white marble do, and crumbled in my hands. I was not allowed to carry off a piece. After making these observations, I conversed freely with the Directors, who were disposed to give full information as to the results of this wonderful discovery. As yet only two fabrics exist—one in Rome and the other in Naples. In London, an imitation has been attempted; but it is limited in its range, not embracing any other varieties than porphyry, giallo antico, and rosso antico, and it is nothing more than a plaster laid over a hard stone, such as lavagna, whereas the Marmoridea is one solid substance. 'Has it been applied to statuary?' I asked.—'Yes, and the Apollo Belvidere had been recently formed of it—a statue which was not an approximation to a likeness, but which was the express image.' It had been submitted to the observation of the Pope and other eminent persons, who had expressed their high satisfaction with it. The pavement of the Church of St. Chrysomelo, which was very much out of repair, has been beautifully restored with this material, and applications are being made from all quarters for ornaments of it for public and private edifices. The ex-Queen, Maria Christina, has recently given some extensive orders for works of the Marmoridea, and the Empress of Russia has been so pleased with it as to permit a project to be submitted to her for the execution of the Laocoon and other statues, which will, in all probability, be executed for Her Majesty. At the same time, a conditional order has been given for lining the walls of the New Cathedral at Moscow, 14 feet deep, with this material, with a cornice inlaid with imitations of the Byzantine. When I say conditional, it depends on a calculation of the expense, which will be very much increased by the carriage to so great a distance. With this great disadvantage, however, the estimated expense is one-third of what would be the expense of marble, and, leaving carriage out of the question, the expense of the artificial is about one-eleventh of the real marble. Hitherto, the application of the Marmoridea, both in Rome and Naples, has been most successful; and the opinion of all who have seen it is one and the same. Should a longer experience confirm all that we have heard and seen, there can be no doubt but that the material is destined to work a great revolution in Art. There is one observation which I have omitted, which is, that besides its vast variety of applications and its power of reproducing exact copies of our most splendid specimens of statuary, it can create marbles which are now no longer to be found."

Coffee and Milk as an Article of Diet. Experiments of D. A. Caron, Physician to the Prisons of the Department de la Seine.*

Speaking of the popular habit of breakfasting on coffee with milk, he says: I have devoted my attention to this subject, and I think I am justified in attributing to this kind of aliment the production of the nervous and leuchorrhœic diseases which principally affect females of every class, particularly those inhabiting large towns. The very general coincidence of the same symptoms with the use of coffee and milk, induced me to examine what might be the cause of those phenomena, and then I was led to investigate what the action of coffee and milk is, and then the action of that mixture on the human economy. I was first obliged to make the analysis of the infusion of coffee, next to determine its physical and chemical properties; I was obliged besides, to submit my first essays to new experiments, which conducted me to a series of most interesting researches, which I now propose to describe.

The infusion of coffee is a liquor of a dark brown, possessing a particular aromatic taste, slightly bitter; the chemical analysis containing the following principles, viz: a coloring matter soluble in water, a volatile empyreumatic oil soluble in alcohol, which is developed by torrefaction, some tannic and gallic acid, some resin and an extract of cafeine. This liquor when warm and sweetened, constitutes a stimulating and pleasing beverage known by every one, but what no one has thought of is, that when in contact with milk, its nutritious properties are neutralized, because of its fermentation being retarded. Having put together some coffee and milk in a bottle, it was 27 days before the mixture began to decompose, whilst milk and sugar were decomposed in three days; chocolate with milk was five days; pure cafeine and milk eleven days. It is evident that the astringent properties of coffee hinder the digestion of milk; but it happens also, that during the action of coffee on the principle of milk, the cafeine is set free and acts on the membrane of the stomach in the same manner as vegetable alkalies, producing the most evident hyposthenisation, a fact which till now has been overlooked. Then Dr. Caron continues to relate the experiments he made on himself, and some other persons willing to submit to the trial, the results of which were general prostration, vital concentration, cephalagia, weakness and trembling of the legs, tottering walk, nausea supervening with fulness of the stomach, constant somnolence, great want of appetite, he having remained since the morning till 11 o'clock at night without eating anything. But what is particularly worth noticing he adds, is the condition of the pulse, which, on the average, was from 80 to 90, and which, under these circumstances, was lowered to 68. At four o'clock in the afternoon it was reduced to 60, and two hours later to 56, when he took food in order to stop the effect. While taking the meal he was subject from time to time to giddiness, flushing of the face, and nausea; after the meal the pulse rose to 72, when he felt much relieved. He con-

* From the Journal of the Society of Arts, No. 228.

tinues farther on and says: A mixture of coffee and milk, as I have stated above, having the property of hindering the fermentation when in vessels, acts identically in the same manner in the stomach, and constitutes an inert liquid, on which the gastric juice has little or no action at all. Dr. Caron continues the account of his experiments, mentioning cases he has treated, and proves ultimately that many patients laboring under irritation, leuchorrhœa, and hysteria, were restored to health by simple tonic treatment after having given up the use of coffee.

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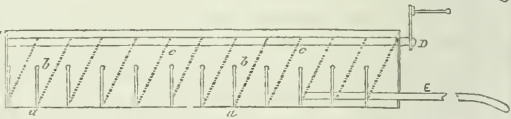
*Description of Williams's Apparatus for Charging Furnaces.**

Mr. C. Wye Williams, of Liverpool, has patented an apparatus by means of which coal or other fuel may be introduced into a furnace, and distributed rapidly and uniformly therein.

Fig. 1 of the annexed engravings is a longitudinal section of the improved apparatus, prepared ready to receive a charge of fuel; and fig. 2 is a longitudinal section of the apparatus after the discharge of the

Fig. 1.

Fig. 2.



fuel through the bottom. It consists of a box or drawer-like apparatus, being open at the top to receive the charge of fuel; *a a* are a series of narrow metal plates, forming the bottom, each moving on pivots, *b b*; *c c* are chains, having one end attached to the horizontal rod or shaft, C D, and the other end secured to the falling edge of each plate, as shown in Fig. 2; D, a winch handle, to rotate the shaft; and E E two handles.

It will be observed that one form of the improved apparatus is of a drawer-like shape, entirely open at the top, the bottom consisting of a series of parallel flat metal plates of any required width, and placed either across from side to side or lengthways from front to back end of the furnace, and are so arranged and attached that they may move somewhat like the laths of a venetian blind. On the shaft, C D, being wound up by the winch handle, the plates forming the bottom are raised and held in their horizontal position by a latch or other suitable catch retaining the winch handle in its place, and on its being removed the shaft is suddenly liberated, when the plates and their respective chains take the position shown in fig. 2. The catch should be so placed that it may be quickly disengaged, and the charging of the furnace completed in a few

* From the Lond. Mech. Mag., Aug., 1857.

seconds of time. Before its being charged with fuel, the box or drawer laying outside the furnace, resting on one or more supports or on the ground, is filled, and on the door being opened, it is run or pushed into the furnace by the handles E E; and on releasing the winch catch the horizontal plates fall suddenly by the weight of the charge of coal or other fuel, each taking a hanging vertical position. By this action the coal falling through the several spaces thus produced is dispersed over the entire surface of the remains of the previous charge, then in an incandescent state, and the box is rapidly withdrawn, and the door again closed. The width of the plates, and that of the spaces between them while hanging vertically, may be made of any required size, according to the nature and size of the fuel for charging wide furnaces; and the side plates, A B, may also be hung on pivots, to deliver the fuel laterally and outwards. For the convenience of using the apparatus, it is furnished with the two handles or bars, E, projecting like the handles of a wheel-barrow on each side, and of any convenient length, so that the stoker standing between them may have full command of the box and the operation of charging with it; its weight being, when pushed in, supported by a cross-bar or like means within the furnace while in the act of being pushed in and drawn out.

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*Statistics of Textile Manufactures of Great Britain.**

The number of factories from which schedules were received by the factory inspectors in 1856, amounted to 5117 against 4600 in 1850, and 4217 in 1838. Of these, 2210 were cotton factories, 1505 woolen, 525 worsted, 417 flax, and 460 silk. The cotton factories have increased 14·2 per cent., and the silk 66 per cent. The woolen trade is becoming concentrated in Yorkshire, and the worsted manufacture is almost exclusively confined to the same county. The flax trade is most vigorous in Ireland. The number of spindles and looms in 1856 was respectively 33,503,580 of the former, and 369,205 of the latter, and the actual horse power given in the returns is 161,435. Power looms have increased from 115,801 (in 1836,) to the number already indicated—viz: 369,205. The average value of the cotton goods and yarn exported in the three years 1853, 1854, and 1855, was, in round numbers, £31,000,000; of woolen and worsted goods and yarn, the average exports for three years amounted to £10,000,000. The number of children employed has decreased considerably in flax and woolen factories, while it has increased in worsted. The total number of children under 13 years of age employed in all kinds of factories last year amounted to 46,071; the number of males between 13 and 18 to 72,220; the number of females above 13 to 387,826; and the number of males above 18 years to 176,400—making a grand aggregate array of 682,497. There were during the half year 1919 accidents from machinery, and 53 not due to machinery. The number of informations was 380, and the number of convictions 245. It is to be regretted that the accident list for the year shows the usual sad catastrophes.

* From the Practical Mechanics' Journal, May, 1857.

For the Journal of the Franklin Institute.

Particulars of the Steamer Cecile.

Hull and engines built by Harlan & Hollingsworth, Wilmington, Delaware. Intended service, Charleston to Savannah.

HULL.—

Length on deck,		161 feet.
Breadth of beam, (molded,)		29 "
Depth of hold,		10 "
" to spar deck,		18 " 1 inch.
Length of engine room,		66 "
Draft of water forward,		4 " 8½ inches.
" aft,		5 " 2½ "
Tonnage,	Hull, 438.	
"	Engine-room 212.	

ENGINES.—Vertical beam.

Diameter of cylinder,		38 inches.
Length of stroke,		10 feet.
Maximum pressure of steam,	35 lbs.	
Cut-off,	5 feet.	
Maximum revolutions at above pressure,	24.	
Weight of engines,	120,000 lbs.	

BOILER.—One—Return flued.

Length of boilers,		22 feet.
Breadth " front,		10 "
" " shell,		9 "
Height " exclusive of steam chimney,		10 "
Weight " with water,	90,000 lbs.	
Number of furnaces,	2.	
Breadth "		4 " 3 inches.
Length of grate bars,		5 " 6 "
Number of flues or tubes,	above 12, below 8,	
Internal diameter " "	above six of	12 "
	"	10 "
Length of " "	above	17 " 2 "
	below	13 " 5 "
Heating surface,		1264 sq.ft.
Diameter of smoke pipe,		50 "
Height " from grate,		45 feet.
Consumption of fuel per hour,	⅝-ton.	

PADDLE WHEELS.—

Diameter over boards,		24 "
Length of blades,		7 "
Depth "		22 "
Number "	20.	

Remarks.—Frames—sketch of shape 1, depth 3 ins × ¾-ins. Number of strakes of plates from keel to gunwale 10; thickness of plates 3-8—5-16—1-4 inch. Description of cross-floors, nine, 15 ins. deep of 5-16 plates. Depth of keel 4; diameter of rivets 5-8; distance apart 2 ins. Single riveted on strakes. Independent steam, fire, and bilge pump, 1; bulkheads, 3; 8 keelsons, 30 inches deep by 12 ins. wide. Main deck open aft, saloon deck and cabin. C. H. H.

*The Abbé Pauvert's Improvements in the Manufacture of Iron and Steel.**

Considerable curiosity has been expressed in reference to the inventions of M. L'Abbé Pauvert, of Chatellerault, France, in consequence of an exciting notice which appeared some time since in the letter of the Paris correspondent of the *Times*. We take the earliest opportunity, therefore, of making known the nature of these improvements in the manufacture of iron and steel. The inventor has obtained patents for three inventions in this country. The first—for "certain improvements in manufacturing iron"—is thus described by him:

"The object of this invention is to deprive or drive off from puddled iron sulphur, phosphorus, and other metalloids, by cementation; it is applicable to puddled iron in any of its stages or states. I employ a cement composed of the following substances:—14 parts (by weight) oxide of iron; 30 highly aluminous clay; 50 carbonate of lime or wood ashes; 4 finely divided charcoal; 1 carbonate of potassa; 1 carbonate of soda. These proportions need not be rigorously adhered to, but may be varied, and one or more of the substances composing the cement may be dispensed with, according to circumstances and the nature of the iron. I place the iron with the cement in layers into a cementing furnace, and I heat the furnace in the ordinary manner. This iron, after cementation, is welded, and then drawn into bars. It thus becomes as soft and as tenacious as iron made with charcoal. The many electric currents produced by the mutual reaction of the elements, the reduction of the earthy and alkaline metals, and of a portion of the oxide of aluminum, favor the escape and the absorption of phosphorus, sulphur, and other metalloids. In order that all the carbon may be decomposed and disappear in the state of oxide or carbonic acid, it is necessary that the carbonates and oxides should be in excess."

The second invention—for "certain improvements in manufacturing cast steel"—he thus describes:

"The object of this invention is to decarbonize cast iron by prepared oxide of iron, and to free it from gaseous and solid metalloids. I crush cast iron heated to a red heat under rolls, or under a tilt hammer, or broad faced forge hammer. The portion of the cast iron reduced to a fine powder serves for the preparation of the oxide, while that which is in coarser particles serves for reguluses or metal. To render the oxydation complete, the powdered cast iron is wetted with pure, acidulated, or alkalized water. To obtain cast steel I have recourse to the processes and apparatuses now used for fusing. I place in a melting pot from 33 to 40 parts (by weight) of oxide prepared as just stated, to 100 parts of crushed cast iron to every 100 parts cast iron; 8 or 10 parts of the following composition are added (which must be kept as free as may be from exposure to the air): 4 parts (by weight) dry carbonate of soda; 4 dry carbonate of potash; 3 wood ashes; 2 borax; 3 oxide of manganese; 4 to 7 hydrogenated carbon, soot, or lamp-black. These ingredients should be carefully mixed, but the number and proportions may be varied according to the product desired. Instead of oxidyzed cast iron, iron filings or iron raspings may be used, the same being oxydized by the same process. Instead of 4 parts dry carbonate of potass, 2 parts caustic potass may be employed. The numerous reactions of these ingredients produce the following effects:—1. The generation of numerous electric currents. 2. Complete reduction of the manganese and oxide of iron (produced by the oxydized cast iron or iron filings) which unite with the steel. 3. Reduction of the earthy and alkaline metals and borax which absorb the metalloids. 4. Disappearance of the *nitrous* gases, because potassium, sodium, and calcium reduced in presence of steel and of carbon in an incipient state absorb *nitrogen* and form cyanides of potassium, sodium, and calcium. 5. Formation of larger crystals in the steel, when it cools down, than have hitherto been produced in steel."

The third invention—for "certain improvements in manufacturing steel and cast steel"—he describes as follows:

"The object of this invention is—1. To purify iron, and to combine it chemically with carbon by cementation. 2. To convert it into cast steel of superior quality, whatever the nature of the iron first employed, I make use of a cement composed of the

* From the Lond. Mech. Mag., September, 1857.

materials and in about the proportions following:—33 parts (by weight) of finely divided charcoal; 33 parts of highly aluminous clay; 33 parts of carbonate of lime or wood ashes; 1 part carbonate of soda; 1 part carbonate of potash. I stratify the iron with this cement in an ordinary cementing furnace, and heat it in the same manner as is now generally followed. I thus obtain a steel possessing all the qualities of that known as German, or 'Rives,' or shear steel (*acier d'Allemagne ou de Rives*). The successive heats and firings do not cause it to part with the carbon which is intimately combined with it, as in cast or in shear steel. And for this reason, carbon having but a small affinity for iron, requires, in order to enter into intimate combination with it, 1st, to be added in an incipient state; 2d, to be assisted in its combination by numerous electric currents. Now these conditions are fulfilled by my process, for—1st. The mutual reaction of the carbon and the carbonates causes the greater part of the carbon to assume a molecular state; 2d. This *change* of the carbon and of the carbonates, the action of the red-hot iron upon the oxides of aluminum, of calcium, of potassium, of sodium, with the carbon in the molecular state, produce or generate numerous currents of electricity. Further, the earthy and alkaline metals appearing in an incipient state, greedily absorb sulphur, phosphorus, and the other metalloids. Thus prepared, this steel may be used as shear steel or German steel (*acier d'Allemagne*), the properties of which it possesses. In order to convert this steel into cast steel, the ordinary processes of fusing in pots is followed, but with the addition to the metal in the pots of from five to six per cent., by weight, of the following mixture, which, as far as possible, must be kept from contact with the atmosphere:—4 parts (by weight) dry carbonate of soda; 4 parts dry carbonate of potash; 3 parts wood ashes; 2 parts borax; 3 parts oxide of manganese; 4 to 7 parts hydrogenated charcoal, soot, lamp-black, &c. The four parts of carbonate of potash may have substituted for them two parts of caustic potash. The mixture of these substances should be effected with care, and their number and proportions may be varied to suit the nature of the products to be obtained."

The reactions of these substances are said to be the same as in the former case.

For the Journal of the Franklin Institute.

Improvement of the Ohio River. Reply to some Remarks of Mr. Ellet.

By W. Milnor Roberts, Civ. Eng.*

In the October number of the *Journal*, Mr. Charles Ellet, Jr., Civ. Eng., invites my attention to an "error" or "oversight," as he terms it, in my paper in the treatment of the question of saving water on the reservoir plan, by means of a modification of Mr. Haupt's plan of low open dams. He, however, disclaims any "wish to participate in the discussion now going on in the *Journal*," &c. In briefly replying, I desire it to be understood, therefore, as entirely separate from, and outside of, the paper now in the course of publication in the same *Journal*.

Mr. Ellet's remarks are calculated, though of course undesignedly, to convey a very erroneous impression as to my position in the controversy. I am not the *advocate* of low dams to be fed with reservoirs. I am the advocate of a regular slackwater navigation to be composed of locks and dams, and not at all dependent on artificial reservoirs, or artificial supply of any kind. At most, I have merely suggested that the plan of low open dams should be retained in the discussion, as auxiliary to the reservoir plan; all of which is directly antagonistical to my own. Here is what I said, in the September number referred to by Mr. Ellet:—"If it can be established beyond question, that this plan (low open dams), as compared with Mr. Ellet's, of keeping up the flow of the unobstructed river, may save two-thirds of the cost of the artificial reser-

* Received too late for insertion in its proper place.—Editor.

voirs, that fact might lead to its adoption as an economical *adjunct to the system of artificial reservoirs*, in case they should be deemed preferable to locks and dams." But I beg to decline being held up as the *advocate* of any plan in any degree connected with artificial reservoirs for making a navigation on the Ohio. My plan is, locks and dams.

At the same time, I may be permitted to add, that the *ipse dixit* of Mr. Ellet, or of any one, is not likely to settle the mooted points. The idea of having a river "standing on an inclined plane," belongs to Mr. Ellet; it is not an invention of mine. I did not even suggest that the river would present a uniform plane, with the system of open dams; nor will it do so, except in floods. If Mr. Ellet will carefully consider the entire question, as stated, keeping in mind that the river is already but a succession of deep pools and ripples, or natural dams, he may yet find that the low open dams would create a navigation about 6 feet deep, with *very much* less water than would be required to keep up the same depth along the unobstructed river. He will observe, that I have not contended that with the open dams in operation, the water would be raised five feet above its original natural plane, on all parts of the river.

He says, "I do not wish to enter into detailed investigation of this problem." To which it may be added, that it is not necessary, at present. But hereafter, should the slackwater plan be discarded in favor of the artificial reservoirs, then the problem will be investigated in detail; when it will perhaps be found to present a new problem. But even should it hereafter be *proved* that such open dams would not save water enough to warrant their use as *adjuncts to the reservoir system*, it would not militate in the slightest degree against the slackwater navigation, the only plan advocated by me, which would rest as before, on its own merits, notwithstanding Mr. Ellet's assertion, at the close of his communication, that locks as well as dams are "*unnecessary*." Any one, with equal propriety, may arrogate the right to assert that *reservoirs* are unnecessary, but I claim no such privilege in a public discussion of this character, because these are the *very points* under consideration: another tribunal must decide who is right, and point out the *corrections* that ought to be made in any of the views the different parties may have expressed.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, October 15, 1857.

John C. Cresson, President, in the chair.

John F. Frazer, Treasurer, present.

B. Howard Rand, Recording Secretary, pro tem.

The minutes of the last meeting were read and approved.

Donations to the Library were received from the Statistical Society of London; L. A. Huguet-Latour, Esq., Montreal, Lower Canada; The Regents of the University of the State of New York, Albany, New York; Hon. James H. Campbell, U. S. Congress; Hon. J. Holt, Commissioner of Patents, Washington City, D. C.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of September was read.

The Board of Managers and Standing Committees reported their minutes.

New candidate for membership in the Institute (1) was proposed, and the candidates (3) proposed at the last meeting were duly elected.

Mr. Marshall exhibited a machine for holding shoes while being manufactured, and intended to facilitate the operations of the workman, and to relieve him from the stooping posture he is compelled to assume when this work is held between the knees. It consists of a tripod, which sustains a vertical post of iron, surmounted by a flat smooth piece, upon which the leather is hammered. Near the top of the post an arm of U shape, is pivoted at one extremity, so as to revolve parallel with the post, and which is balanced to remain in any desired point of its revolution, by a strap of india-rubber attached to a fixed part of the post, and a pin in the crank keyed on the pivot. A vise is attached to the outer end of the U arm, and is ingeniously contrived to hold a last of any length, and in such a way as not to interfere in the slightest manner with getting at the leather of the shoe. The post is telescopic to suit any height; and the workman can sit or stand, as he prefers.

The machine has been submitted to the Committee on Science and Arts, for an investigation into its merits, and their report, which may be looked for in this *Journal*, will contain a more complete description of the machine.

Mr. Howson exhibited specimens of Mr. Newell's Photograph Portraits.

The process by which these pictures are produced, is the discovery or invention of Mr. Robert Newell. They are made by crystallizing a photograph or other picture on paper, and securing the photograph thus prepared between two plates of glass by a transparent cement, which renders the whole impervious to air or dampness, securing durability in any climate. The coloring is then applied, which, being transmitted through this transparent medium, produces the peculiar softness and natural appearance of texture, while it preserves every line, expression, and feature precisely as taken by the camera. The whole effect is to produce a picture more exact in tints, shadows, and colors, and more perfect in its minutest details, than has heretofore been obtained; at the same time there is a roundness and stereoscopic appearance which no other picture possesses without the aid of the stereoscope itself.

Mr. Jones exhibited a Fabric for Ladies' Skirt Hoops, invented by Mr. Pickering, of Cincinnati. It consists of a spiral spring, the interstices of which are filled with cotton or other like substance, so as to form a foundation for an exterior knitting, which is accomplished by the ordinary bobbin knitting machine.

Mr. Jones exhibited a specimen of sleeve fasteners, invented by B. F. Grinnell, of New York and Jersey City. Mr. Jones observed that there was a curious history attending this simple invention, that an interference

had been declared by the Patent Office, that hundreds of miles had been traveled over to procure testimony, which occupied over 700 pages, and the arguments upward of 120 pages.

The Patent Office has awarded priority to Mr. Grinnell.

Mr. Howson exhibited the following inventions:

1. A new ash-sifter, which, by means of peculiarly formed rockers, effectually agitates the ashes.

2. A square having a mitre formed on the handle; invented by Mr. Morse, of this city.

3. A governor of peculiar construction, by which an extended amount of direct lift may be obtained; invented by Mr. Van Velthroven, of this city.

4. A new cutter for wood turning lathes, which can be readily sharpened by simply grinding, and without the necessity of resorting to the forge for the purpose.

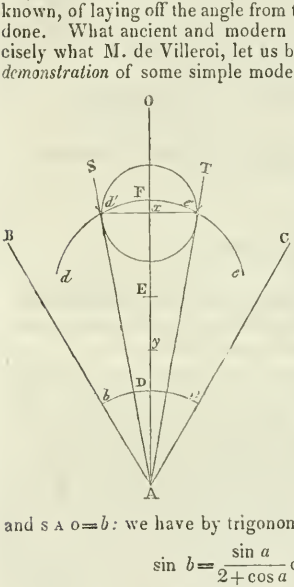
5. A machine for measuring dry goods, invented and patented by William Wythes, of St. Clair, Schuylkill County.

BIBLIOGRAPHICAL NOTICE.

Solution of the Problem of the Trisection of an Angle by the simple Processes of Geometry; that is, solely by means of the Rule and Compass. By B. de Villeroi, Bordeaux : A. Pechade. 1856.

We owe to the kindness of the author, a copy of the above interesting pamphlet, and as he appears to desire an opinion upon it, we will take the liberty of expressing one. The opening paragraph shows that M. de Villeroi's claim is no small one. Listen to him. "The problem of the trisection of an angle by the simple processes of Geometry, has been for a long time sought by the ancient geometers, *and abandoned as impossible by the moderns*, who have ranked the solution with equations of the third degree. But in mathematics, as in every other science, the last word is not yet said. *Learned men should often, if not from modesty, at least from circumspection, substitute in their decisions* the *word 'undiscovered'* for '*impossible.*' Galileo, Christopher Columbus, Franklin, Mongolfier, Fulton, and others, frequently gave the lie, not to science, but to scientific bodies. The same will be the case for the trisection of an angle, ranked by learned men with the philosopher's stone, perpetual motion, and the quadrature of the circle, and which, notwithstanding the authority of academies, and the influence of centuries, is about to descend from the region of the third power, to the humble and simple manœuvre of the rule and compass. I will leave to great mathematicians the development of the scientific theory, the corollaries, and all the consequences of this famous problem, submitting to them merely my practical observations. Satisfied to be able to present the material fact of the solution, and to be able to say, *as Archimedes did for the square of the hypothenuse:* "*I have found it—I have found it.*"

Now, we will not go into the inquiry as to whether the abovementioned great men ever gave the lie to anything or any body; nor as to whether Archimedes found the law of the square of the hypothenuse, which is generally attributed to Pythagoras, but we cannot help remarking that M. de Villeroi's ideas of the problem appear to be confused. A solution of the problem by rule and compass is not a *geometrical* but a *mechanical* one, and has, so far as we are aware, never been sought at all; nor do we see that the present mode is any better than the one long known, of laying off the angle from the scale of chords, which is as easily done. What ancient and modern mathematicians have sought, is precisely what M. de Villeroi, let us be permitted to say, has *not found*, a *demonstration* of some simple mode of trisecting an angle.



But we have a still more serious objection to M. de Villeroi's problem; not only he cannot show it to be right, but we, having no claims to be considered a great mathematician, can show it to be wrong.

His method is as follows: bisect the given angle C A B, by the straight line A O, and on this line set off A D, D E, and E F equal to each other, with the centre, E, and distance, E F, describe an arc, and from F, lay off the arcs, F d', F e' equal to D b and D c: draw the chord d' e', cutting A O in x: with x as a centre and radius equal x d', describe a circle, and draw the tangents to this circle A S and A T from the point A. According to M. de Villeroi, S A T is the third of B A C.

Now calling the angle B A O $=a$, and S A O $=b$: we have by trigonometry.

$$\sin b = \frac{\sin a}{2+\cos a} \text{ or } \frac{\sin a}{\sin b} = 2+\cos. a.$$

Also, by the well-known trigonometrical formula, $\frac{\sin 3b}{\sin b} = 3-4 \sin^2 b.$

$$\text{Then if } b=\frac{a}{3} \text{ we have } (1-4\sin^2 b)(\cos b-1)=0.$$

Which can only be true when $b=0°$, $30°$ or $150°$. $a=90°$.

The maximum error occurs when $a=72°$ about.

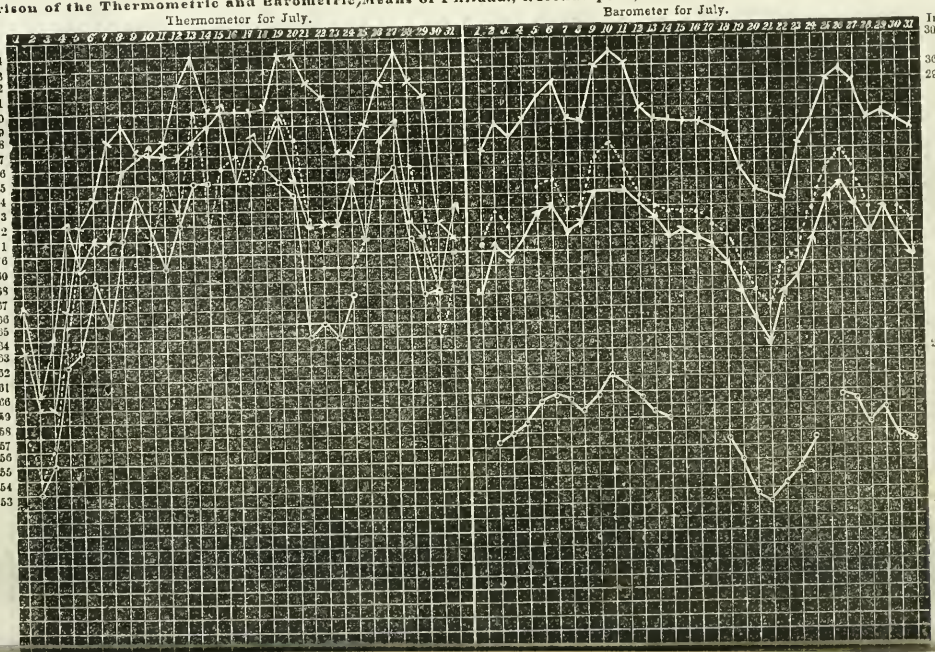
Are we then asking too much of M. de Villeroi, in advising him in his own language, "if not from modesty, at least from circumspection," to substitute in his decision the words "*I thought I had found*," for "*I have found*."

Abstract of Meteorological Observations for August, 1867, made in Philadelphia, Somerset, Huntingdon, and Northampton Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

August, 1867.	Philadelphia,—Lat. 39° 57′ 28″ N, Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. Kirkpatrick, Observer.								
	Barometer.		Thermometer.				Relative humidity. 2 P. M.	Force of vapor. 2 P. M.	Rain.	Prevail'g winds.
	Mean.	Mean daily range.	Mean.	Daily range.	Mean daily range.					
	Inch.	Inch.	°	°	°		Per ct.	Inch	Inches.	
1	29·660	·086	77·3	17·0	5·5		56	·635		S W.
2	29·735	·046	79·3	17·0	3·3		41	·492		N W.
3	29·825	·090	79·7	19·0	1·0		44	·530		S W.
4	29·768	·073	79·8	18·5	1·5		50	·628	2·568	S E.
5	29·670	·112	74·0	5·0	5·8		81	·704	0·260	N.
6	29·865	·195	74·0	7·0	0·7		68	·614	0·431	S W.
7	30·009	·144	76·3	18·0	3·0		52	·671		S E.
8	29·984	·027	75·8	17·0	0·5		49	·533		S E.
9	29·880	·104	78·2	14·5	2·3		61	·717		E.
10	29·664	·216	74·2	7·5	4·3		83	·724	2·767	S E.
11	29·605	·154	75·0	19·5	6·2		54	·602		W N W
12	29·871	·266	78·7	15·5	3·7		54	·692		(var.)
13	29·809	·101	83·7	18·0	5·0		55	·788		S W.
14	29·714	·095	87·0	19·0	3·3		52	·852		S W.
15	29·701	·053	84·2	14·0	3·8		61	·847	0·378	W.
16	29·888	·186	77·5	11·0	6·7		51	·564		(var.)
17	29·823	·097	77·2	14·0	0·7		67	·730	0·372	(var.)
18	29·786	·080	73·0	10·0	4·2		63	·582	0·019	(var.)
19	29·838	·053	71·8	15·0	2·8		56	·515		S E.
20	29·878	·040	72·2	16·0	1·0		46	·442		W N W
21	29·945	·067	72·5	18·0	0·7		47	·464		N.
22			71·2	17·0	2·0		57	·549		N E.
23			71·0	15·0	0·8		54	·536		(var.)
24			66·0	15·0	5·0		54	·442		W.
25			67·8	15·0	1·8		51	·463		W.
26			70·2	18·0	2·7		50	·490		S.
27			69·5	13·0	2·7		46	·540	0·844	S.
28			78·0	20·0	8·5		49	·588		S W.
29	29·650		75·[illegible]	18·0	3·0		62	·636	0·200	(var.)
30	29·869	·219	[illegible]	17·0	4·5		47	·428		N W.
31	30·005	·136	72·3	21·0	3·2		49	·481		N W.
Me's			75·3	15·3	3·2		55	·590	8·039	s 63½ w
Me's for summer.	29·701	·093	74·0	44·0	3·4		57	·576	18·858	s.47°w

August, 1867.	Somerset, Somerset Co.—40° N., Lon. 79° 3′ W. Height about 2750 ft. Geo. Mowry, Observer					Huntingdon, Huntingdon Co. Jacob Miller, Obs'r			Easton, Northampton Co.—Lat. 40° 43′ N. Lon. 75° 16′ W. Height above the sea about 320 feet. Selden J. Coffin, Observer.					
	Barometer.		Thermometer.		Rain.	Prevail'g winds.	Ther.	Rain.	Prevail'g winds.	Barometer.		Thermometer.		Rain.	Prevail'g winds.
	Mean.	Mean daily range.	Mean.	Mean daily range.			Mean.			Mean.	Mean daily range.	Mean.	Mean daily range.		
	Inch	Inch.	°	°	Inches.		°	Inch.		Inch.	Inch.	°	°	Inch.	
1	27·585	·048	67·3	3·4	0·034	S W.	69·0		W.	29·347	·090	72·3	4·3	0·04	S.
2	27·650	·061	64·0	3·3		N W.	68·0		W.	29·417	·070	68·7	3·7		N W.
3	27·670	·030	69·3	5·3		S W.	72·0		(var.)	29·397	·080	70·7	2·0		S W.
4	27·617	·058	68·0	6·7	0·424	S.	70·0	0·065	S.	29·435	·077	72·3	1·7		S E.
5	27·558	·062	67·0	5·7	0·207	N.	69·0	0·069	N.	29·320	·127	70·0	4·3	0·09	(var.)
6	27·724	·140	65·0	2·0	0·004	N E.	70·5		N E.	29·543	·223	72·3	2·3		S E.
7	27·822	·098	68·3	3·3		S S E.	72·0		S.	29·703	·160	73·0	0·7		S.
8	27·824	·068	73·3	5·0	0·021	W.	78·0		S.	29·653	·110	71·0	2·0		W.
9	27·757	·068	72·3	3·0		N W.	76·0	0·241	N.	29·540	·143	74·7	3·7	} 1·02	(var.)
10	27·450	·267	67·3	5·0	1·500	W S W	67·5	1·626	S.	29·310	·230	67·7	7·0		S E.
11	27·542	·162	67·0	1·7	0·034	W.	68·0		W.	29·220	·150	69·7	5·0	0·22	W.
12	27·712	·169	71·0	4·7		W.	71·5		N W.						E.
13	27·740	·029	74·3	2·3		W.	82·5		W.	29·477		78·2			(var.)
14	27·760	·040	76·3	3·3	0·074	W.	81·0	0·020	W.	29·393	·083	80·2	2·0		N W.
15	27·669	·034	75·3	1·0		W.	73·0		N.					0·12	(var.)
16	27·723	·057	69·0	0·3	0·116	N.	75·5		N.	29·573					(var.)
17	27·664	·059	74·0	5·0	0·123	W.	78·0	0·457	W.	29·457	·117	70·0		0·40	S E.
18	27·667	·031	66·3	7·7	0·741	W N W	65·0	0·026	N.	29·456	·073	67·0	3·0	0·01	(var.)
19	27·728	·001	64·3	5·3		W.	66·0		W.	29·513	·063	67·5	2·8	0·01	(var.)
20	27·760	·035	68·7	5·7		N W.	64·5		N.	29·577	·063	64·0	3·5		W.
21	27·780	·051	62·0	5·3		S.	64·5		N W.	29·637	·060	63·3	2·7		(var.)
22	27·559	·230	62·3	2·3	0·124	(var.)	65·0	0·300	S.	29·487	·150	66·8	3·5	0·01	S W.
23	27·513	·099	58·0	4·3	0·014	W.	60·0	0·044	W.	29·233	·253	60·3	0·8		S W.
24	27·739	·226	55·3	5·3		(var.)	58·0		N W.	29·407	·233	61·7	4·7		(var.)
25	27·885	·146	59·3	8·0		W.	58·0		S E.	29·740	·273	63·0	6·0		S W.
26	27·853	·040	65·3	6·0		S.	70·5		S.	29·757	·043	64·7	1·7		S W.
27	27·618	·235	66·0	7·3	0·076	S.	63·0	0·073	S.	29·570	·173	67·7	3·7	0·04	S E.
28	27·505	·122	64·0	3·3	0·018	W.	66·5		W.	29·200	·310	72·0	4·3		(var.)
29	27·578	·073	60·0	4·0	0·023	W N W	65·0	0·495	W.	29·293	·033	66·2	5·8		W.
30	27·785	·207	55·3	4·7		(var.)	58·0		N.	29·520	·227	60·8	5·3		W.
31	27·880	·094	58·7	7·3		W.	65·0		N.	29·675	·153	64·7	5·5		W.
Me's	27·668	·098	65·0	4·7	5·128		68·9	4·316		29·482				3·46	
Me's for summer.															

Comparison of the Thermometric and Barometric Means of Philada., Northampton, Somerset, and Huntingdon Counties.



JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DECEMBER, 1857.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Practical Views on the Proposed Improvement of the Ohio River. By W. Milnor Roberts, Civil Engineer.

(Continued from page 303.)

Appendix B.—Facts Connected with Dams and Rivers.

Monongahela River.—Below Brownsville the river banks are generally from 30 to 50 feet high, except two or three instances, where they are not more than 25 feet. The average width of the river is 900 feet. The lower bottom lands seldom exceed 300 yards in width, on one side only; the *widest* being less than half a mile near Pittsburgh.

Above Brownsville, thence to the State line of Virginia, the river banks are from 35 to 55 feet high. The average width of the river is 600 feet. The lower bottom lands from 50 to 200 yards wide, on one side only.

Kentucky Rivers.—The following information was furnished by Sylvester Welch, Esq., Civil Engineer, to the writer in 1839. Mr. Welch at that time was Chief Engineer of the State of Kentucky.

"The floods in the Green River rise from 40 to 50 feet, and in the Kentucky River from 30 to 55. The Licking River having more descent seldom rises over 40 feet.

"There are several mill-dams upon the Licking from six to ten feet high. When the river rises from eight to twelve feet, or higher, (about five feet on the dams,) *flat boats with full loads* of iron, or agricultural

produce, pass over them without inconvenience. When the water is five feet or more upon the wier of the dams, the surface below rises so as *nearly to coincide* with the surface above. *A canoe could then pass with safety.*

"When we can do so conveniently, we make the lifts of our locks about fifteen feet, but they vary from *ten* to *eighteen.*

"All the works in our rivers will be covered with water during high floods. We raise our lock walls ten feet on the Kentucky, and eight feet on the Licking, above the top of the dam. The abutments will be raised a little higher than this.

"When the water runs so as to be *eight or ten feet* deep on the weir of the dams, the surface below will come up *nearly to the same level* as that above, (the fall will be distributed along the pool,) and steamboats may pass up or down over the dams. When the water rises much above this, there will be no perceptible difference between the level of the surface above and below the dam, and the current will not be strong enough to act injuriously upon the banks of the river, or upon the works connected with the dams."

The following facts were derived during the same year, (1839,) from Edward F. Gay, Esq., Civil Engineer. They are contained in his report relative to a survey he made along the Allegheny River, in 1828. These remarks refer to the slackwater navigation on the Conestoga navigation, constructed by him; and they are the result of practical observations. He states, "that previous to the improvement of that stream, high-water marks were seen along its banks from *ten* to *twelve* feet above the surface of common low water. This was said by all to be the usual height of the freshets; and from this fact, the possibility of constructing permanent dams on the stream was doubted by many. The dams, however, were built, varying in height from *ten* to *fourteen* feet above the bed of the stream; and in no instance since their construction has a rise of the freshets in the ponds exceeded *three* feet; whereas, in the unimproved parts of the river, the same complaints are heard of its rise as formerly.

"This extraordinary difference is easily accounted for by its increased surface in the pools, and its unobstructed discharge over the dams."

On the same subject we would present some extracts from the report of Sylvanus Lothrop, Esq., who was the Chief Engineer of the Monongahela slackwater navigation in 1846. "It affords me great satisfaction to be enabled to state, that since the last annual report, the navigation has not been interrupted or delayed in a single instance, by the breaking or failure of any part of the works or fixtures connected with the improvement, but has continued in successful operation at all times, when free from ice, except on a single occasion, and that *for one day only*, when it was partially obstructed by a flood in the Monongahela, so high as to cover two of the locks, *and to enable steamboats* to pass over the dams." "The walls of the locks being *ten* feet above the combs of the dams, it would require a rise of *more than* 20 *feet* in the natural condition of the river to submerge them. It may be proper, however, to remark in connexion with this circumstance, that, so far as the public is

concerned, a casualty of this sort, how frequently soever it might happen, would be attended *with no inconvenience* to them whatever, as the boats and other craft engaged in the navigation can always pass over the dams, whenever, and even before, the operation of the locks is suspended by high water. The principle which has heretofore generally been admitted, is now *ascertained by actual* experience and observation to be correct, that whenever the waters of the Monongahela swell to an elevation of *eight feet upon the combs* of the dams, they *then cease to back the water*, and the flood is no higher in consequence of their erection. The fall being then distributed along the pools, and the surface nearly equalized, both above and below, they can be passed in either direction by steamboats of the largest class employed in the trade, without hazard or delay."

Comment upon such facts, thus clearly presented, would be superfluous. But in justice to Mr. Lothrop, another extract from the same report seems proper, as containing the views of a gentleman of admirable cool judgment, and great practical experience. Mr. Lothrop says, "There is another point of view, however, in which this work may be considered important to the country at large. Its successful completion and opening (although under circumstances the most adverse,) at an expense scarcely one-half of that of our ordinary lines of canal, while its capacity for business is so immeasurably greater than any work of that description which has ever been constructed, are calculated to furnish another striking illustration of the advantages of this species of improvement, and thereby to lead to the earlier development of the susceptibilities of our Western streams. To the Ohio River itself, which is the common highway of so many States, and to many other of its most important tributaries, its applicability will be found, on examination, to be not less apparent, than to the Monongahela."

We take the following from the Ninth Annual Report of the President of the Monongahela Navigation Company:

"The stockholders will no doubt be gratified to learn, as the Board are to inform them, that, as in former years, no interruption has occurred in the navigation for a single day, from any of those causes to which this improvement was supposed to be so peculiarly exposed; high and low water have proved alike harmless; while the favorite idea of a long obstruction from the formation of ice upon its deep and quiet pools has been exploded by the fact that, for the *last three winters*, the boats employed in the trade have been making their daily trips to Brownsville, *while the river was locked up by ice beyond that point.*" A fact like this is of more practical value than any theory, however beautifully elaborated.

Extracts from the Report of the President of the Monongahela Navigation Company, dated January 6, 1851:

"On the third day of November, 1844, your navigation was completed, (29 miles had been completed and in use four years longer,) and the locks opened for the passage of boats; and during the period that has since elapsed, of more than six years, it has been *subjected to the severest tests of floods and ice* without suffering any material injury, or requiring

any extraordinary repairs, and is now in good order, thus giving the strongest demonstration of the strength and durability of the work.

"The amount of toll collected during the six years since the completion of the work, is as follows, viz :—

For the year	1845,	$28,579·70
"	1846,	43,422·39
"	1847,	54,261·90
"	1848,	56,623·93
"	1849,	53,756·32
"	1850,	64,318·31

"The shipment of coal increased from 4,605,185 bushels in 1845 to 12,297,967 bushels in 1850.

"It is gratifying to be able to state, that during the year 1850, the *navigation was not suspended a single day by ice or any other obstruction.*"

Probably no canal in the United States, at any period of its history, can claim such exemption from interruption.

Mr. Ellet, in his *eighth* objection to locks and dams, founds it mainly upon an accident which occurred at one of the locks on the Monongahela, in 1851, which interfered with the navigation four days. In order that all who feel interested should be able to judge how much weight it is entitled to, an extract from the Annual Report of Gen. Moorhead, President, dated January, 1852, is here given.

"The obstruction referred to, was the result of a forcible displacement of the lower gates, occasioned by an ascending boat, while the steamer *Atlantic* was in the act of passing in the same direction through the upper ones. Through some mistake or mismanagement on the part of the pilot of the former, she was driven by the force of steam against the lower gates, with such a momentum as to force one gate upwards against the full head of water, while its fellow, left without other support than the mitre sill, and exposed to the whole force of the accumulated flood, was swept downward and torn from its fastenings by the violence of the current. The effect was, of course, to close the upper gates at once upon the *Atlantic*, with a force that held her there as though she had been compressed by the jaws of a vice, while the torrent rushed through the lock with all the force and velocity which a head of eight feet would naturally impart to it. Fortunately, however, a pair of new gates was *in course of preparation* and *nearly* completed; and although the extrication of the steamboat, and the shutting off the water from the lock proved to be a laborious and expensive task, it was successfully accomplished, and the new gates suspended, under the personal superintendence of the President, within four days of the occurrence of the accident."

"In order, however, to provide against the recurrence of any similar casualty, arrangements were made for the preparation of extra gates."

In Mr. Ellet's reference to this, as a disaster to be apprehended on the Ohio, he inadvertently states that the gates were *ready*, whereas, they happened to be only nearly ready. But now, when we see a navigation successfully carried on for over seventeen years, with but a solitary accident of this nature; and when we know that all public improvements having locks where steam is used are subject to the same, and we hear of no fellow to such an accident, how much consideration should be given

to it in a comparison of the advantages and disadvantages of a great system!

In the same Annual Report, it is stated, that "the excessive cold with which this region has been visited, at the commencement of the present winter, resulted, as might have been expected, in locking up the whole river, and entirely suspending navigation as early as the 17th of December." "A like occurrence took place in 1846, when the navigation was interrupted for a period of three weeks; and then, as now, the *accumulated masses of ice passed off without doing* any material damage to the structures under our charge.

"Since the winter of 1846, until the present one, navigation has never been suspended three days at one time in consequence of ice; and judging from past experience, we may not anticipate a similar interruption for many years to come."

Drought, 1854.—In 1854 there was a great drought. It is thus mentioned in the Annual Report of the President of the Company, of January, 1855:

"In July, however, the effects of the drought began to be felt; and on the 27th of that month, the water became so low that the large packet boats ceased to run during a period of nearly three months, and were not able to resume their trips until the 17th of October. During a part of that time, however, smaller boats were run; but the water was still so low, that even they could carry little or no freight, and the common coal flats could not be towed over the improvement with full loads: in fact, business upon the river during that period was virtually suspended, *an occurrence heretofore entirely unprecedented.**

"A slight rise about the middle of October enabled the packets to resume their trips; but the water did not rise sufficiently to let out the coal boats, which were loaded for the western markets, until after Christmas.

"Many of these boats were loaded in May, and kept afloat at the expense of their owners during the entire summer and fall. The water, during the greater part of that time, not only ceased to run over the dams, but by evaporation and leakage became almost literally dried out of the pools."

1855.—Extracts from the sixteenth Annual Report of January, 1856.

	STATEMENT OF COAL BUSINESS.	
	Number of bushels.	Amount of tolls.
1845	4 605,185	$ 5,283
1846	7,778,911	10,221
1847	9,645,127	13,211
1848	9,819,361	12,438
1849	9,708,507	13,533
1850	12,297,967	17,023
1851	12,529,228	17,850
1852	11,630,811	20,014
1853	15,716,367	21,291
1854	17,331,946	25,079
1855	22,234,009	31,050

* When the navigation had been in use fourteen years.

"An examination of the quantity of coal that passed the improvement during the last year, and the revenue derived from it, shows the toll to be but *one mill and four-tenths* per bushel, or less than *four cents* per ton! A tax so inconsiderable should not be complained of, particularly as the construction of the improvement has greatly augmented, if not created, the business." *Yes, it created it!*

"Another important feature in the coal business worthy of remark is, that the transportation of it to Cincinnati, Louisville, and many other places, is *now done in barges* instead of the old-fashioned boats. These barges are towed down and back by steamboats built for the purpose." "By this means the cost of boats is saved. A great saving is also effected in running them, as one steamboat will tow down from eight to twelve barges, and the same number back empty. It is believed that by that mode, coal can be delivered from one to two cents per bushel cheaper (28 to 56 per ton,) in western ports than by the old system. When the Ohio River is improved by the construction of an artificial navigation, as it should and it is hoped will be by the aid of the General Government, these coal barges can be run during the entire season, except when navigation is suspended by ice. The regularity with which coal could then be supplied, would increase the demand to an unlimited extent."

"The Board are pleased to see public opinion turned to this subject. It is one of great and national importance, and passing, as the Ohio River does, through six States, commends itself to the fostering care of the General Government."

1856.—The year 1856 was a memorable one, not only on the Monongahela River, but on all western streams, and especially on the Ohio and Mississippi rivers. All were much lower than they were ever known to be before, while the interruptions from ice were also beyond all precedent. Thus from January 1st to March 23d, and from December 21st to December 31st, making 94 days, closed by ice during the year 1856.

From 1845 to 1855 inclusive, eleven years, the average annual interruption from ice was but 20 days, whilst in the single year of 1856, there were 94 days. This shows most strikingly the great severity of that winter.

But this was a year of disaster to the navigation company. "On the 14th of May a breach occurred in Dam No. 2, carrying away nearly two hundred feet in length of that structure, which greatly interrupted the navigation. Immediate and active measures were taken to repair it, and the work was accomplished at an expense of more than seventeen thousand dollars. The river commenced falling immediately after this disaster occurred, and with the exception of a slight rise of about two feet, during the progress of the work, the stage of water was very favorable for making the necessary repairs. After these were completed, and the navigation resumed, the river continued to fall, until the water became so low in the different pools, as to suspend the navigation entirely: [*drought*,] and from the 14th of May until the 1st of December, a period of more than *six months*, there was at no time a sufficiency of water either in the *Monongahela* or *Ohio* rivers to float coal boats."

"Some idea of the extreme lowness of the river may be gathered from the following statistics, which are so remarkable as almost to challenge belief; but as the measurements were made with great care, at different points, and by different persons, and corroborate each other, they form strong proofs of the facts."

"Below Dam No. 4 [a few miles below Brownsville,] the water was gauged by the President of the company, on the 1st day of October, 1856, and the quantity passing per minute, was found to be but 1492 cubic feet. Mr. Charles Stewart, the Engineer, gauged it at the Brownsville Bar, on the 8th of October, 1856, and the quantity passing per minute was 1365 cubic feet. In 1838, W. Milnor Roberts, Esq., gauged the Monongahela at its lowest stage, and ascertained the quantity passing to be, per minute, 12,000* cubic feet—more than eight times as much as either of the above measurements. Charles Ellet, Esq., made examinations during the summers of 1843, 1844, and 1845, at the Wheeling Bar, and the minimum quantity reported by him was, September 30th, 1844, about 70,000 cubic feet per minute. Nothing could more forcibly illustrate the extreme lowness of the water than these figures; and as the great drought of this year continued for so long a period, it satisfactorily explains the small receipts of the Company."

Appendix C.—Disinterested Testimony.

Time of passing Locks, Cost, &c.

Extract from a report published by a company of gentlemen who made an excursion of examination along the Monongahela Improvement in 1845, after the entire completion to Brownsville.

"The subscribers were especially pleased with the opportunity afforded them, of examining the substantial workmanship of the locks, and the admirable machinery by which the gates are worked on the Monongahela slackwater. They were both surprised and gratified to find that the very large locks could be filled, and the steamboats passed through each of them, with a detention not exceeding SIX MINUTES. They were thus fully convinced, that a durable improvement has been made, which secures safe and rapid communication between Pittsburgh and Brownsville, except when closed by ice."

The names appended, are, N. B. Craig, Esq., Hon. R. C. Grier, Hon. John C. Plummer, John Anderson, Esq., B. B. Hart, Esq., Philadelphia, Henry Hall, Esq., Balt., Lieut. John Rodgers, U. S. N., C. H. Fuller, Civ. Eng., Hon. James Bell, C. W. Smith, Esq., N. O., E. J. Martin, Louisville, Col. Robert Orr, J. L. Neff, Maryland, Lieut. J. L. Parke, U. S. N., John D. Davis, William Eichbaum, Josiah King, and others.

And yet, without regarding evidence of any kind, and the experience of twelve more years of successful navigation on that work, the

*The measurements which gave 12,000 cubic feet per minute, was above, but near *Pittsburgh*.

It is true, that one of the measurements of the writer at Brownsville, August 30th, 1838, gave 12,420 cubic feet per minute. It was, however, measured again, September 19th, and found to be 4500 cubic feet, and this was the *actual* period of the lowest water during that extraordinary season.

opponents of the lock and dam system, continue to assert, though without any proof whatever, that hours instead of minutes are to be consumed in the passage of a single lock. And in regard to cost: a new lock, with chamber 250 by 56 feet, planned in 1852, by Sylvanus Lothrop, Esq., then Chief Engineer, was estimated to cost $45,000.

In 1853, the company determined to extend the slackwater from Brownsville to the Virginia State line, and thus refer to it in their report of January 2d, 1854:

"An accurate survey of the river from the mouth of Red Stone Creek to the State line, was made in September last, by John White, Esq., a highly competent engineer. The entire ascent to be overcome by the dams, is 41·8 feet, corresponding very nearly with the original survey made in 1838, by Mr. Roberts. Mr. Lothrop, the Engineer of the company, proposes to overcome this by three dams of *fourteen* feet each, which have been located by him and the President, as follows:

"No. 5, at Bennett's Bar, 2 miles above Brownsville.

"No. 6, at Rees's Landing.

"No. 7, at Jacob's Creek, lower ripple.

"It is believed that the three locks and dams can be constructed, for cash, for about one hundred and fifty thousand dollars." But $50,000 each!

These dams are five feet higher than those proposed on the Ohio river, being 19 feet from the bed of the stream, and 14 feet from the pool—the height from pool to pool being 6 feet more than on the Ohio. They are therefore necessarily more costly structures *per foot of length*, though only about half the average length of the dams proposed on the Ohio. The locks will also have 6 feet more lift than those proposed on the Ohio; other dimensions being equal, the additional lift would, of course, increase the cost. From this it may be inferred that the estimate of cost in the Ohio, as contained in the paper of the writer, is liberal.

Appendix D.—Facts in Relation to Navigation on the Ohio River.

The following letter in answer to certain interrogatories submitted by F. R. Brunot, Esq., of Pittsburgh, is from one of the most experienced and reliable captains navigating our western waters.

Between Pittsburgh and Cincinnati.

1. The best stage of water for the packets would be about 15 feet at Pittsburgh and 20 feet at Cincinnati.

2. From Pittsburgh to Cincinnati, time down about twenty-eight to thirty hours. Has been done in 27 hours down, and 44 hours and 57 minutes up.

3. The average landings down in a business trip would be about 22—up about 40. When running against time, as was the case when the shortest time was made, mentioned in my answer to your second question, the landings down would not be more than two or three, and up they would stop their engines long enough to take a wood or coal flat in tow about three times, *not landing at all.*

4. The higher the water the more time lost in rounding to—about fifteen minutes would be a fair average.

5. The average time out from Port to Port round trip, is about five and a half days. About thirty-three hours lost at Cincinnati, and about eleven hours landing.

6. In low water, the time consumed in the round trip, would not be much greater than that in a "high water trip;" they are longer going down, but lay a shorter time at Cincinnati, and up perhaps from *six to twelve hours* longer than in high water.

7. During the flood of 1847, some of the boats came into Port at Cincinnati and had to lay up, not being able to discharge their cargoes. Others stopped for fear of not being able to get fuel on their route. During the flood of April, 1852, I had to lay over one trip, and lost a week with the "*Allegheny*," (one of the Pittsburgh and Cincinnati packets,) on account of the "Wheeling Bridge"—river being too high to let her Pilot House pass under, after her chimneys were lowered.

8. The ordinary rates of freight in good stages of water up from Cincinnati to Pittsburgh were, last spring, about fifteen cents per 100 pounds, and in very low water twenty-five and thirty cents per 100 lbs.

9. It most assuredly would be advantageous to the steamboat interest to have a full regular supply of good coal for steamboat use at moderate rates always on hand at all points along the river, as the boats here are all so constructed as to burn coal altogether when they can get it.

10. For economy, and quick to generate steam, we think the Pittsburgh coal the best in the western or southern country.

11th Question. How much of each year, on an average, are steamboats laid up on account of low water in the Ohio River?

Answer. This depends somewhat on the season, whether wet or dry; in ordinary seasons the packets were laid up about *three and a half months* on an average, but they are constructed for speed and of heavy draft; we have a class of boats that run the whole summer, or as long as there is twenty inches of water in the channel.

12th Question. Suppose we had a stillwater lake between Pittsburgh and Cincinnati, what would be the probable time required to make the round trip, no current either way? Could it be made quicker than in the natural river on a good stage? How much, probably?

Answer. I think the time required to make a round trip from Pittsburgh to Cincinnati and return by one of our packets on "stillwater," would be about five days. The ordinary time in a business trip I have said in my answer to your fifth question, is about five and a half days, round trip. One-sixth of the difference is saved in not having to round to going down, the balance in having no current to contend with up stream."

C. W. Batchelor.

In a slackwater navigation, as proposed, there would be fifty-four locks between Pittsburgh and Cincinnati. Allowing twelve minutes for each lockage, it would amount to $10\frac{3}{4}$ hours each way, or $21\frac{1}{2}$ hours in the round trip. Hence, it would appear that even with the natural river

in a favorable stage, as compared with the slackwater navigation, the difference of time in a round trip would be trifling; and in low water, that difference would be in favor of the slackwater. There are various other considerations which the intelligent communication of Captain Batchelor cannot fail to suggest to the reader, some of which have been discussed in the text. The equalization and reduction of the cost of freighting which will surely attend the opening of the slackwater navigation, is not the least among them.

While the season of 1856 was remarkably unfavorable for river business on account of long continued low water, causing immense losses to merchants, manufacturers, and others, and curtailing and injuring the coal trade; that of 1857, owing to a better supply of water, has been quite favorable. As a consequence, the commercial and other interests along the river have been in a highly prosperous condition, and the coal business has been greatly stimulated. This extensive business will this year exceed a million of tons, and quite a large proportion of it is now carried on by means of *barges*, even with the river in its natural state; so that what was considered experimental a few years ago, is now an established custom. It needs only a constantly reliable navigation to render it universal.

Appendix E.—Respecting the Improvement of the Mississippi River.

The United States Government has been engaged for several years, in the execution of a plan for improving the lower rapids of the Mississippi.

These rapids are designated as the "Des Moines rapids" or "lower falls." They extend from Montrose to Keokuk, at the extreme south-eastern corner of Iowa, and occupy about 12 miles of the river.

The total fall in this distance is 24 feet, or an average of 2 feet per mile—divided between a number of ripples and pools.

The stream is from three-fourths of a mile to one mile in width.

Its bed is solid limestone rock; not in one smooth even declivity, but disposed, as just intimated, into *comparatively* level parts, and intervening broad flat ridges, extending across the stream; partially broken by a very irregular winding channel, which in low water becomes useless.

In very low water, vessels drawing two feet cannot pass. During floods, and generally for about two or sometimes three months of the spring and early summer, steamers drawing four feet, or more, can ascend and descend; and during this period, the immense rafts of timber and lumber from the upper waters, float safely over. But usually, for the remainder of the year, even light steamers are compelled to run the falls empty, while the freight is conveyed by lighters, drawn by horses. Occasionally, of late years, small steam tugs, instead of horses, have been used part of the time.

During the present year (1857), a railroad has been opened along the west bank of the river from Keokuk to Montrose, 11 miles, affording a new conveyance for passengers and freight, *around* the falls. This is

the first completed division of the Keokuk, Mount Pleasant, and Muscatine Railroad.

About 10 years ago, a company was incorporated under the laws of Iowa, with authority to construct a *hydraulic ship canal* around the rapids. Surveys, maps, estimates, and reports, were made. Nothing more has yet been done, except to continue the company in being.

The plan adopted by the General Government is, to blow out the rocks under water, so as to form an artificial channel through the flat ridges, sufficiently wide and deep for the convenient passage of steamers and other craft, at all times.

Although several years have elapsed since this work was commenced, and many thousands of dollars have already been expended, very little has yet been accomplished. Nothing that is yet of any practical use. It is evident to those who have had opportunities of witnessing the scene, and the operations, knowing the short period each season during which they can be carried on, that many years of tedious and costly labor will be required to complete a channel on this plan. When completed, the channel would be crooked; and although steamers might ascend it safely, some trouble would be encountered in descending. It is doubtful whether the large rafts could be navigated through it at all.

The effect of cutting such channel, or channels, through the ridges, (which are in fact rock-dams) must necessarily be, to *reduce the natural depth* in the intervening pools, and on the ridges, and in all parts of the stream, except immediately in the channels. In the channels, the depth must be increased, though not to the full extent of the excavated depth; while, at the same time, the velocity of the flow through the channel will be greater. The worst effect will be, the reduction in the depth of water *above the head of the rapids* at Montrose, and for some distance above. This may prove to be a serious evil, inasmuch as there are shoals on that part of the river which will not admit of any reduction in the depth of water over them without permanent injury to the navigation.

A more philosophical, and the writer thinks, a more feasible and much cheaper plan, admitting of completion in one, or at most two seasons, would augment the depth in the channels, and increase the depth on the shoals immediately above the rapids. Thus, instead of attempting to blow out a channel through the solid rock ridges, let the channel be formed by bolting timbers (on the ridges,) across the stream from either shore; leaving a given width, say 500 feet, near the middle, or in the most convenient part, in its natural state. Suppose three lines of square timber laid side by side bolted to the solid rock; two lines of timber bolted on this lower course; and one line of timber bolted to the second course; we have a solid timber dam, say 3 feet high above the top of each ridge. This would raise the water at each ridge not less than 2 feet—perhaps 2½ feet or more, and afford 4 or 5 feet depth from one end of the rapids to the other, at the same time raising the water at the head of the rapids, not less than two feet above the low water height. Assuming the river to have an average width of 4500 feet, and that there should be eight such semi-dams, it would take 192,000 feet lineal of 12 inch square timber at 30 cents per foot; and allowing 270,000

pounds of wrought bolts, at 15 cents per pound, and twenty per cent. for contingencies, the entire cost would be but $153,720!

Another mode of improving these rapids is, by means of a *single dam*, raising the water 24 feet at the lower end, with two locks of 12 feet each, which is entirely practicable, at a cost of less than a million of dollars!

Ultimately, should the General Government fail to improve these rapids radically; and perhaps in any event, the hydraulic ship canal will be constructed on the Iowa side by the company named, affording one of the most magnificent water powers in the world, and giving a constant reliable navigation. A small portion of the surplus water will be used in supplying the growing City of Keokuk with pure wholesome water. Is there any good reason why the government should not construct this canal?

ERRATA.

Page 23, line 12—after the word "*even*" there should be a comma.
" 17—for "*shores and*" read "*thousand.*"
24, " 8—for "*cleaning*" read "*clearing.*"
26, " 6—for "*cleaning*" read "*clearing.*"
76, " 15—for "*high*" read "*height.*"
78, last line for "*draughts*" read *droughts.'*
80, line 17—for "*draught*" read *drought.*"
80, " 20—for "*foot*" read "*feet.*"
84, " 20—the semicolon should be a colon.

For the Journal of the Franklin Institute.

*On the Calculation of Road Excavations and Embankments, when the Ground is a Warped Surface.** By W. M. Gillespie, LL. D., Professor of Civil Engineering in Union College, N. Y.

When an engineer is laying out a road or railway, he has to determine the amount of earth necessary to be removed in making the "cuts" and "fills" of the road. To do this, his most usual course is to take "cross sections" or "profiles," of the ground at right angles to the line of road, at convenient intervals, and then to calculate by various methods, commonly near approximations, the volume included between each pair of these cross-sections. The distances apart at which these cross-sections are taken, are determined by the engineer according to the nature of the ground; his aim being that there shall not merely be no abrupt change of height between each pair of these cross-sections, but that the surface from one to the other shall *vary uniformly;* gradually passing, for example, from a small to a great degree of slope, or from a slope to the right into a slope to the left, without any sudden variation at any one place.

The surface fulfilling this condition of varying uniformly, since it is everywhere straight in some direction, is evidently a *ruled surface;* and since the extreme profiles are seldom parallel, it will be a *warped* or *twisted* surface.

Our engineers have been accustomed to consider these surfaces as not admitting of precise calculation, but only of a degree of approximation

*An abstract of the earlier portion of this paper was read at the late Montreal meeting of the "American Association for the Advancement of Science."

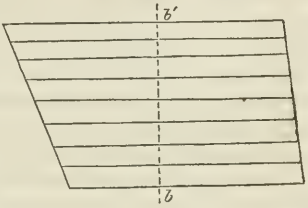
varying with the nearness of the cross-sections.* The object of this paper is to examine the correctness of this position. It will therefore have two parts: firstly, a discussion of the precise nature of the surface; and secondly, an investigation of a formula applying to it.

I. *What sort of a warped surface is the one in question; that is, what is its mode of generation?*

To determine this, we must inquire what the engineer means when he says that the ground "varies uniformly" from the place at which he stands, and at which he has just taken a cross-section, to the place at which he decides it will be proper to take the next cross-section; whether he means that the ground between the two is straight *cross-wise* or straight *length-wise;* straight at right angles to the direction in which the road runs, or straight in that direction.

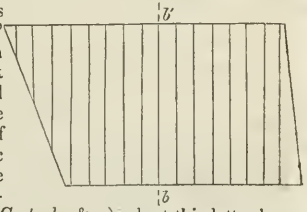
Probably few engineers ask themselves this question in so many words; but it would seem that the former conception, or *straightness cross-wise*, is the more likely to be what is meant, for the reason that any deviation from straightness in that direction, at right angles to the line along which we look, is much more easily seen than in the other direction. We can therefore much more readily determine whether the surface of the road is straight or curved from side to side than from end to end; and the surface which we pronounce uniform, is therefore much more likely to be straight cross-wise, than straight length-wise.

Fig. 1.



In geometrical language the former surface (which is represented in plan in fig. 1,) is generated by a straight line resting on the two straight lines which join the extremities of the two profiles, and moving parallel to their planes or perpendicular to the axis of the road. This surface is a "*hyperbolic paraboloid.*"

Fig. 2.

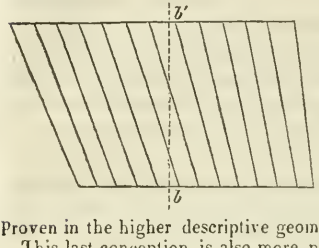


The latter surface (shown in plan in fig. 2,) is generated by a straight line resting on the two profiles, and moving parallel to the vertical plane which passes through the axis of the road. It also is a hyperbolic paraboloid, though a different one from the former. The French engineers (*Sganzin* I, 114; *L'Ecole Centrale, &c.,*) adopt this latter hypothesis. We have seen, however, that the former is the more probable one.

*"No practicable method of calculation will give a true result if the surface of the ground is much warped." Morrison's Tables, p. 13. "In railroad cuttings, it rarely happens that the ground surface lying between two consecutive cross-sections one hundred feet apart is absolutely unwarped; yet for practical purposes it may very frequently be assumed to be so. When much warped, the cross-sections must be taken closer together than one hundred feet." Trautwine's "New Method," p. 1.

The French hypothesis is farther objectionable on mathematical grounds. As soon as the generating line quits the end lines and rests on the side lines, it has new directrices, and the whole surface generated, is really composed of three different paraboloids; a want of symmetry alone is sufficient to cause the rejection of this system.

Fig. 3.



Fortunately, the practical difference between the two, is really very slight; for a very small change in the latter hypothesis will make its result identical with that of the former. Conceive the straight line which rests on the two profiles to move on them in such a way as always to divide them *proportionally*, as in fig. 3. The surface thus generated is identical with that of fig. 1; as is Proven in the higher descriptive geometry.

This last conception is also more probably correct than fig. 2—even if we suppose the engineer to consider longitudinal straightness—since he is more likely to extend his imagination from all parts of one profile to the corresponding parts of the other, than in lines perpendicular to the profile on which he stands.*

II. *We will therefore now proceed to investigate the content of a solid, bounded on one face by a warped surface generated on the first hypothesis —the other faces being planes.*

We will take the case of an Excavation; that of an Embankment being the same inverted.

We will begin by considering the bottom of the excavation to be level, and its sides to be vertical; and will afterwards discuss the more usual form.

Fig. 4.

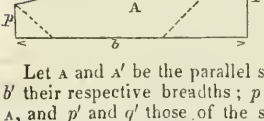
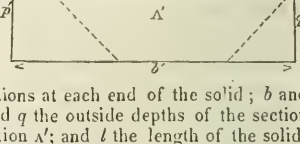


Fig. 5.



Let A and A' be the parallel sections at each end of the solid; b and b' their respective breadths; p and q the outside depths of the section A, and p' and q' those of the section A'; and l the length of the solid, measured at right angles to the planes of the sections.

*Since the above was written, the author has seen an abstract of the Lectures on Roads, given at "*L'Ecole des Ponts et Chaussées*," (the highest authority on such matters in France, and therefore in the world,) in which this last hypothesis is adopted. This removes the only obstacle to the acceptance of the principle which is here advocated.

In the models illustrating the original paper, the surfaces in question were formed by silk threads, representing the generating lines. The identity of the first and third surfaces, and the dissimilarity of the second, were then evident on mere inspection.

The outside depths are supposed to vary uniformly from p to p', and from q to q'.

Then, at x feet from A, the breadth $= b + \frac{x}{l}(b'-b)$; one outside depth

$$= p + \frac{x}{l}(p'-p); \text{ and the other } = q + \frac{x}{l}(q'-q).$$

The area of that section will therefore be

$$\tfrac{1}{2}\left[b + \frac{x}{l}(b'-b)\right] \times \left[p + \frac{x}{l}(p'-p) + q + \frac{x}{l}(q'-q)\right] \quad . \quad (1)$$

Arranging this expression according to the powers of x it becomes,

$$\tfrac{1}{2}\left[b\,(p+q) + \frac{b(p'-p+q'-q) + (b'-b)(p+q)}{l}x + \frac{(b'-b)(p'-p+q'-q)}{l^2}x^2\right]$$

The product of this by dx being the differential of the solid, the required volume is,

$$\int_o^l \frac{1}{2}\left[b\,(p+q)\,dx + \frac{b\,(p'-p+q'-q) + (b'-b)\,(p+q)}{l}x\,dx\right.$$
$$\left. + \frac{(b'-b)\,(p'-p+q'-q)}{l^2}\,x^2\,dx\right] \quad . \quad . \quad . \quad (2)$$

Integrating from o to l, we obtain this expression,

$$\left[\tfrac{1}{2}b(p+q)l + \tfrac{1}{2}b(p'-p+q'-q)l + \tfrac{1}{2}(b'-b)(p+q)l + \tfrac{1}{3}(b'-b)(p'-p+q'-q)l\right]$$

Performing the operations indicated and factoring, we finally obtain for the required volume of the solid, this symmetrical formula,

$$\tfrac{1}{6}\,l\left[(b + \tfrac{1}{2}\,b')\,(p+q) + (b' + \tfrac{1}{2}\,b)\,(p'+q')\right]^* \quad . \quad (3)$$

We now propose to show that the volume given by the preceding formula (3) is the same as would be obtained by applying the familiar prismoidal rule to the given solid.

The area of the section $A = \frac{1}{2}\,b\,(p+q)$; and that of the section $A' = \frac{1}{2}\,b'\,(p'+q')$.

*Two particular cases of this general formula are worthy of special notice.

Let the base of the given solid be a parallelogram.

Then $b = b'$; and formula [3] becomes,

$\frac{1}{6}\,l\,[\frac{3}{2}\,b\,(p+q) + \frac{3}{2}\,b\,(p'+q')]\,l = b\,l \times \frac{1}{4}\,(p+q+p'+q') =$ The product of the base of the warped surface prism by the arithmetical mean of the heights of its four summits.

Let the base be a triangle.

Then $b' = o$, and $p' = q'$; and formula (3) becomes,

$\frac{1}{6}\,l\,[b\,(p+q) + b\,p'] = \frac{1}{2}\,b\,l \times \frac{1}{3}\,(p+q+p') =$ The product of the base by the arithmetical mean of the heights of the three summits.

These two formulæ are also true when the upper surface of the prism is a plane, since a plane is only a particular case of a hyperbolic paraboloid. They thus give a general proof of the well-known rules for the content of truncated prisms, which have triangles or parallelograms for bases.

The area of the section midway between A and B,

$$=\tfrac{1}{2}\left[\left(\frac{b+b'}{2}\right)\left(\frac{p+p'}{2}+\frac{q+q'}{2}\right)\right]$$

Adding together the areas of A and B, and four times the middle area, and multiplying the sum by $\frac{1}{6}\,l$, we obtain,

$$\tfrac{1}{6}\,l\,(b\,p+b\,q+b'p'+b'q'+\tfrac{1}{2}\,b\,p'+\tfrac{1}{2}\,b\,q'+\tfrac{1}{2}\,b'p+\tfrac{1}{2}\,b'q)$$

which can be decomposed into the following:

$$\tfrac{1}{6}\,l\left[(b+\tfrac{1}{2}\,b')\,(p+q)+(b'+\tfrac{1}{2}\,b)\,(p'+q')\right] \quad . \quad (3')$$

This expression is identical with the general formula (3) before obtained.

We thus arrive at the conclusion that *the familiar "Prismoidal formula" can be applied with perfect accuracy to such solids as we have discussed, having one of their faces a warped surface generated as in our first or third hypothesis.*

We have thus far been supposing that the road-bed was horizontal, or, in more general terms, that the base of the solid was perpendicular to its ends. The base may, however, make oblique angles with them. Then, to reduce the solid which we have been discussing to this form, we must take from it a wedge-shaped solid, the breadths of whose ends are b and b', and one of whose depths is zero.

But the prismoidal rule also applies to this wedge, and therefore to the solid which remains after it is taken away from our original solid; since all the areas enter the formula only by addition or subtraction, with a common multiplier.

Again, the solids occurring in excavations and embankments, usually have sloping sides, (as shown by the dotted lines in figures 4 and 5,) instead of the vertical sides which we have used in our investigation.

But the solids to be removed to reduce our original solid to this form, are frusta of pyramids, to which the prismoidal formula also applies, and therefore to the new solid in question; for the reasons given in the preceding paragraph.

We will take as an example an excavation of which A and A′, are cross-sections, 100 feet apart. All the dimensions will be in feet. In section A, fig. 4, let $p=6$ and $q=15$. In section A′, fig. 5, let $p'=18$, and $q'=12$. The sections have the side slopes, 1 to 1, shown by the dotted lines. The bottom width of each $=18$.

Then, the area of A $=279$, and that of A′ $=486$. The middle area, obtained from the mean of the outside depths, ($\frac{1}{2}\times(6+18)=12$, and $\frac{1}{2}\times(15+12)=13{\cdot}5$) is $391{\cdot}5$.

Then the content of the solid by the *prismoidal rule* $=38{,}850$ cubic feet.

The same rule can be applied directly to "*Three-level ground*," *i. e.*, ground given by cross-sections, in which three levels have been taken, viz: one at the centre, and one on each side at the points where the side slopes meet the natural surface. The middle cross-section being obtained

from the mean of the levels at each end, the prismoidal rule can be at once applied.

In the case of "*Irregular cross-sections*," in which the inequalities of the surface of the ground have rendered it necessary to take more than these three levels, the rule will still apply after the following preparation. Conceive a series of vertical planes to pass through all the points on each cross-section, at which the transverse slope of the ground changes, and at which, therefore, levels have been taken, and to cut the other cross-section so as to divide the widths of the two *proportionally*.

Then the surfaces between these planes may be regarded as generated on our third hypothesis, and can therefore be calculated by the prismoidal rule; since it has been shown to apply to the surfaces of the first hypothesis, and these are known to be identical with those of the third. Thus, considering the ground on one side of a centre line, let one cross-section have depths of 6·00 in the centre, and 10·00 outside cutting. Let the other end be 8·00 in centre, 12·00 at four feet from centre, and 6·00 outside cutting. Let the half width of road bed be 10 feet, and side slopes 1 to 1. Then the vertical plane passing through the 12·00 level, at 4 feet, a quarter of the whole width (10+6), from centre, should cut the other section at one-quarter its width (10 + 10), or 5 feet, from centre. The depth at this point would be $6+\frac{1}{4}(10-6)=7{\cdot}00$. This enables us to get a middle area; its depth being $\frac{1}{2}(8+6)$ at centre, $\frac{1}{2}(12+7)$ at $\frac{1}{2}(4+5)$ from centre, and $\frac{1}{2}(6+10)$ at the outside cutting.

The prismoidal rule can now be used. A similar preparation for calculation can be applied to cross-sections composed of any number of levels. The labor is much less in practice than it appears in description.

If the views here presented should meet with general acceptance, engineers would be enabled to economize much time and labor, since they would no longer feel themselves under the necessity of taking their cross-sections so near together that the ground between them should be approximately plane, but could take them as far apart as the ground varied uniformly, no matter how much or how far that might be.

The comparison of the results obtained on this principle, with those given by the usual methods, particularly that of "*Equivalent mean heights*," now usually employed when perfect accuracy is desired, will form the subject of another paper.

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*On the Strength of Pillars of Cast Iron.** By Eaton Hodgkinson, Esq., F. R. S., Professor of the Mechanical Principles of Engineering, University College, London.

In a previous paper on this subject (*Philosophical Transactions*, 1840), I had shown,—1st, that a long circular pillar, with its ends flat, was about three times as strong as a pillar of the same length and diameter with its ends rounded in such a manner that the pressure would pass through the axis, the ends being made to turn easily, but not so small as to be crushed by the weight; 2d, that if a pillar of the same length and dia-

* From the Lond., Edin., and Dub. Philos. Mag., August, 1857.

meter as the preceding had one end rounded and one flat, the strength would be twice as great as that of one with both ends rounded; 3d, if, therefore, three pillars be taken, differing only in the form of their ends, the first having both ends rounded, the second one end rounded and one flat, and the third both ends flat, the strength of these pillars will be as 1—2—3 nearly.

The preceding properties having been arrived at experimentally, are here attempted to be demonstrated, at least approximately.

The pillars referred to in my former paper were cast from Low Moor iron No. 3; they were very numerous, but usually much smaller than those used in the present trials. I felt desirous, too, of using the Low Moor iron in the *hollow* pillars employed on this occasion, not on account of its superior strength, but its other good qualities. The pillars from this iron were cast 10 feet long, and from $2\frac{1}{2}$ to 4 inches diameter, approaching in some degree, as to size, to the smaller ones used in practice. The results from the breaking weights of these were moderately consistent with the formulæ in the former paper, with a slight alteration of the constants, rendered necessary by the castings being of a larger size, and therefore softer than before, a matter which will be adverted to further on.

The formulæ for the strength of a hollow pillar of Low Moor iron No. 2,—where w is the breaking weight, in tons, of a pillar whose length is l in feet, and the external and internal diameters D and d in inches, the ends being flat and well bedded—are as below:

$$w = 46{\cdot}65 \times \frac{D^{3{\cdot}55} - d^{3{\cdot}55}}{l^{1{\cdot}7}},$$

from formula in Phil. Trans. 1840;

$$w = 42{\cdot}347 \times \frac{D^{3{\cdot}5} - d^{3{\cdot}5}}{l^{1{\cdot}63}},$$

from formula in present paper.

To obtain some idea of the relative strength of different British irons, I applied, at Mr. Stephenson's suggestion, to Messrs. Easton and Amos, who procured for me twenty-two solid pillars, each 10 feet long and $2\frac{1}{2}$ inches diameter, cast out of eleven kinds of iron (nine simple irons and two mixtures). The pillars were all from the same model, and were cast vertically in dry sand, and turned flat at the ends, as the hollow ones had been; two being cast from the same kind of iron in each case. The simple unmixed irons tried were as below, and all of No. 1.

		Mean breaking weight.
Old Park iron,	Stourbridge,	29·50 tons.
Derwent iron,	Durham,	28·03 "
Portland iron,	Tovine, Scotland,	27·30 "
Calder iron,	Lanarkshire,	27·09 "
Level iron,	Staffordshire,	24·67 "
Coltness iron,	Edinburgh,	23·52 "
Carron iron,	Stirlingshire,	23·52 "
Blaenavon iron,	South Wales,	22·05 "
Old Hill iron,	Staffordshire,	20·05 "

The mean strength of the pillars from the irons above, varies from 20·05 to 29·50 tons; or as 2 to 3 nearly.

The pillars formed of mixed irons were found to be weaker than the three strongest of the unmixed series.

From many experiments, it was shown that the weight which would crush the pillars, if they were very short, would vary as 5 to 9 nearly.

The pillars in general were broken of four different lengths, 10 feet, 7 feet 6 inches, 6 feet 3 inches, and 5 feet, the ends of all being turned flat, and perpendicular to the axis. It was found that when the length was the same, the strength varied as the 3·5 power of the diameter; and when the diameter was the same and the length varied, the strength was inversely as the 1·63 power of the length. Both of these were obtained from the mean results of many experiments.

The formula for the strength of a solid pillar would therefore be

$$w = m \times \frac{d^{3.5}}{l^{1.63}},$$

where w is the breaking weight, d the diameter in inches, l the length in feet, and m a weight which varied from 49·94 tons in the strongest iron we tried, to 33·60 tons in the weakest.

The ultimate decreement of length, in pillars of various lengths but of the same diameter, varies inversely as the length nearly. Thus the ultimate decreements of pillars 10 feet, 7 feet 6 inches, 6 feet 3 inches, and 5 feet, vary as 2, 3, $3\frac{1}{2}$, and 4 nearly, according to the experiments, from which it appeared that the mean decreement of a 10-feet pillar was ·176 inch.

Irregularity in Cast Iron.—The formulæ arrived at in this paper are on the supposition that the iron of which the pillars are composed is uniform throughout the whole section in every part; but this was not strictly the case in any of the solid pillars experimented upon. They were always found to be softer in the centre than in other parts. To ascertain the difference of strength in the sections of the pillars used, small cylinders $\frac{3}{4}$-inch in diameter and $1\frac{1}{2}$ inches high, were cut from the centre, and from the part between the centre and the circumference, and there was always found to be a difference in the crushing strength of the metal from the two parts, amounting perhaps to about one-sixth. The thin rings of hollow cylinders resisted in a much higher degree than the iron from solid cylinders. As an example, the central part of a solid cylinder of Low Moor iron No. 2, was crushed with 29·65 tons per square inch, and the part nearer to the circumference required 34·59 tons per square inch; cylinders out of a thin shell half an inch thick, of the same iron, required 39·06 tons per square inch; and other cylinders from still thinner shells of the same metal required 50 tons per square inch, or upwards, to crush them.

As these variations in cast iron have been little inquired into, except by myself, and have never, so far as I know, been subjected to computation, I have bestowed considerable trouble upon the matter, in an experimental point of view, and endeavored to introduce into the formulæ previously given, changes which will in some degree include the irregularities observed.

AMERICAN PATENTS.

List of American Patents which issued from September 1st, to September 29th, 1857, (inclusive,) with Exemplifications.

SEPTEMBER 1.

27. For an *Improvement in Sewing Machines;* Orson C. Phelps, Rochester, New York.

Claim.—"Constructing the needle bar of sewing machines with a cap or helmet on its top, and a spring, or other elastic material which is equivalent in its effect, as india rubber, air, &c., interposed between the parts for the purpose of giving a yielding bearing to the thread both in drawing in the stitch, and when the shuttle passes the loop, whereby a very fine thread may be used without breaking, and a better seam produced in consequence of the even tension of the thread, and gradual drawing in of the stitch."

28. For an *Improvement in Gas Regulators;* John H. Powers, Newark, N. J.

Claim.—"The arrangement of the inverted cup-shaped valve and its seat of quicksilver and the lever, which connects the said valve with the pressure cup all within the pressure cup."

29. For an *Improvement in Cotton Seed Planters;* Thomas J. Rogers, Cassville. Georgia.

Claim.—"Forming one side of the eduction aperture of a cotton seed planter of the extremity of a sharply vibrating plate, when the opposite side of said aperture is formed of an adjustable flaring concave."

30. For an *Improvement in Lanterns;* Joseph H. Bohrman, Philadelphia, Penna.

Claim.—"1st, Constructing square frame lanterns with the corner uprights of square wire or metal rods, and the door frame of a single square wire or rod bent in U form. secured at its ends by a strip. 2d, In combination with square wire corner uprights, the peculiar attachment of the guard wires by simple grooves and dove-tailed ends. 3d, Forming tongues in the bottom and top plates, or either, for spring stops to secure the glasses in position, and also for the admission of air necessary to the combustion of the lamp flame."

31. For an *Improved Mode of Adjusting Carriage Tops;* C. W. Saladee, Columbus, Ohio.

Claim.—"Extending the 'top prop' back of the 'rest iron,' a sufficient length to form the lever, in combination with the lateral rod. Also, the scroll spring, in combination with the 'pivot iron' and the back bow (or to either of the other three bows), for the purpose of assisting in raising the top, and likewise to prevent its falling with the full force of its own weight, when in the act of throwing it back."

32. For an *Improvement in Means for Attaching Whiffle-trees to the Tow Lines of Canal Boats;* Andrew Seaman, Amsterdam, New York.

Claim.—"The shaft, with tongue attached, in combination with the bar, with lever attached, the above parts being fitted to the rods."

33. For an *Improvement in Smoothing Irons;* Wm. F. Shaw, Boston, Mass.

Claim.—"Making the flat iron with ascending and descending flues, inlet and discharge openings, arranged in the body of the iron, and so as to be used with a burner and stand."

34. For an *Improvement in Portable Gas Generators;* Warren A. Smith, Boston, Massachusetts.

Claim.—"The tubular retorts for the manufacture of oil gas."

35. For an *Improvement in Instruments for Drawing the Curve of Circular Stair Railings;* George S. Stewart, Meadville, Pennsylvania.

Claim.—"The construction of a machine with an adjustable table, and the graduated

post and arm, adjusted with the set screws and the semi-circle, or any other substantially the same, which will produce the same result."

36. For an *Improved Apparatus for Suspending Eaves-troughs;* James A. Waltrous, Green Spring, Ohio.

Claim.—"The employment of a metal strap, in combination with cross-bar and the slotted plate, for securing and readily adjusting eave-troughs."

37. For an *Improved Machine for Planing Saw Teeth;* John N. Wilkins, Waukegan, Illinois.

Claim.—"The two planers or cutters fitted within the case, and operated in combination with the guide or cross-piece within the case, the whole being arranged and applied to the saw."

38. For an *Improved Machine for Forging Metals;* Elbridge Wheeler, Feltonville, Massachusetts.

Claim.—"Operating the roll at stated intervals by means of cams and levers, or their equivalents, whereby I am enabled to roll a piece or bar of metal to a given pattern."

39. For an *Improvement in Pipe Coupling;* Elizur Wright, Boston, Mass.

Claim.—"The use of a compressible packing ring inserted in a groove around the pipe on each side of the joint, in combination with screw threaded or flanched and bolted couplings, and a thimble for holding the packing ring in the grooves, so as to form a water-tight joint, and resist separation by the packing ring serving as a dowel."

40. For an *Improvement in Percussion Cap Primers;* George W. Baker, Burlington, Vermont.

Claim.—"The percussion cap primer whose improvement consists in the peculiar construction which enables one side of the case of said primer to serve as an elastic cap retainer at the side of the outlet of said case."

41. For an *Improved Mode of Moving Stores, &c., in case of Fire;* Asa Blood, Sen., Norfolk, Virginia, and Robert W. Brown, Washington, D. C.

Claim.—"The manner for moving the adjustable stalls by means of the lever, rod, and clinch, on rollers and track."

42. For an *Improved Mode of Attaching Scythes to Snaths;* Oliver Clark, Henrietta, Assignor to Aaron H. Pinney, Columbus, Ohio.

Claim.—"The metallic block, in combination with stirrup bolt, collar, and scythe heel."

43. For an *Improved Sliding Rest for Lathes;* Eleazar S. Gardiner, Assignor to Smith, Gould & Co., Philadelphia, Pennsylvania.

Claim.—"The revolving collar, with its square eye, when the same is employed in conjunction with the steady rest of a turning lathe, for which a patent was granted to Albin Warth, on the 10th day of October, 1854."

44. For an *Improved Machine for Crozing and Chamfering Staves;* Henry L. McNish, Assignor to self and David C. Butler, Lowell, Massachusetts.

Claim.—"The self opening and closing clamp, or its equivalent, so geared to other parts of the machine, as to operate periodically corresponding with the motion of the feed rollers. Also, making the clamps adjustable to croze staves of barrels of different diameters."

45. For an *Improvement in Condensers for List Speeders;* William Mattison, Assignor to John C. Whitin, Northbridge, Massachusetts.

Claim.—"The self-adjusting weight or condenser, applied and retained in its position by the casing or bonnet, or its equivalent."

46. For an *Improvement in Head Rests for Railroad Car Seats;* Wm. M. McCauly, Assignor to J. N. McIntire, Washington, D. C.

Claim.—"Pivoting the rocker or shank of the head plate in the stationary holder, in combination with the segmental spring, whereby the head plate accommodates itself to any inclination of the head and forms a springing or elastic support."

47. For an *Improvement in Carding Engines;* Horatio N. Gambill and Singleton F. Burgee, Woodbury, Maryland; patented in England April 14, 1857.

Claim.—"Delivering the cotton on to the main cylinder always at two and sometimes at three different points or places, whilst using but one set of feeding rollers. Also, the combination of the working cylinders, and the working and stripping cylinder, all running in the same direction, and working in connexion with each other, and with the main cylinder, the two first delivering the cotton to the main cylinder regularly, whilst the latter is doing so at intervals. Also, mixing the strippings taken from the main cylinder by the stripping cylinder, with the cotton on the cylinder, carding it, and returning it thus mixed and carded to the main cylinder. Also, in combination with the cylinders, the stationary casing, and the concave for separating the dirt from the cotton, whilst undergoing the carding process. Also, in contradistinction from giving the variable motion to the cylinder of cone pulleys and a traveling belt attached to each carding engine, the giving of said motion to a shaft or line of shafting, and imparting it from said shafting to the engine by simple belt and pulleys, by which means more certain action is had and at less expense."

48. For an *Improvement in Casting Bearings in Iron Wheels;* Charles Taylor, Little Falls, New York.

Claim.—"The employment of the bevel or oval cap piece, or its equivalent, when it is used in connexion with pins, or their equivalents."

49. For an *Improved Socket-Coupling for Lathes;* George N. Towbridge, Lowell, Massachusetts.

Claim.—"The combination of the spring and pin with the conical shank and socket, with straight screw attached."

SEPTEMBER 8.

50. For an *Improvement in Coal Sifters;* Sanford Adams, Boston, Massachusetts.

"My invention consists in the manner of supporting the sieve so as to be rotated, or partly rotated, within the box or barrel to which it is applied."

Claim.—"Attaching the sieve to the bottom of the rotating spindle, and the spindle to the cover of a barrel."

51. For an *Improvement in Seed Planters;* Cyrus C. Aldrich, Faribault, Minnesota.

"This invention relates to an improvement in that class of seed planting machines, in which the seed or grain is discharged from the peripheries of the wheels on which the device is mounted."

Claim.—"The box provided with the plunger, when said plunger is operated by the lever frame."

52. For an *Improvement in Corn Planters;* D. R. Alden, Unionville, Ohio.

Claim.—"Operating or rotating the wheel by means of the belt, having knobs attached, and the wiper wheel attached to the shaft of the wheel."

53. For an *Improvement in Corn Planters;* Horace R. Allen, Athens, Ohio.

Claim.—"The lever, pins, scraper, spring, and rake, and in combination with the spout and valve."

54. For an *Improvement in Tubes for Steam Pressure Gauges;* E. H. Ashcroft, Boston, Massachusetts.

Claim.—"The tube formed by incasing one tube within another."

55. For an *Improved Machine for Cutting Figures out of Sheet Metal;* C. P. S. Betts, City of New York.

Claim.—"The combination of the blade or shear with the stationary blade or bed shear, whereby the said shear or blade, acting against the shear or blade, first perforates and then cuts the sheet of metal or other material; and this I claim whether the shear or blade be made stationary or adjustable for varying the cutting angle."

56. For an *Improvement in Insulated Telegraphic Wires Inclosed in Metallic Tubing;* Samuel C. Bishop, City of New York.

Claim.—"A new manufacture, consisting of wire insulated by a covering of gutta percha or india rubber, firmly inclosed in a coating of lead or other ductile metal."

57. For an *Improvement in Reversible Railroad Car Coupling;* Joseph Boothroyd, Michigan City, Indiana.

Claim.—"The device by which my couplings revolve, so as to present either a bell mouth or a link, and at the same time admit of all necessary play to accommodate the motion of the cars."

58. For an *Improvement in Processes for Manufacturing Verdigris;* Ludwig Brumlen, Hoboken, New Jersey.

Claim.—"1st, To use all these refuse liquids from chrome yellow and white lead to make verdigris of them. 2d, To use the remaining liquid from verdigris to make Paris green of. 3d, To use the remaining liquid from Paris green again, for making chrome yellow. 4th, To use the refuse liquid from verdigris again for verdigris. 5th, The manufacture of verdigris, Paris green, and chrome yellow, from the different waste liquids."

59. For an *Improvement in Gas Retorts;* Saunders Coates, City of New York.

Claim.—"Forming a false bottom for gas retorts from metal of dissimilar degrees of fusibility, viz: one auch as lead in combination with one such as iron, resting upon the easily fusible metal."

60. For an *Improved Wrench;* H. M. Clark, New Britain, Connecticut.

Claim.—"The combination with a hook or claw griper hinged to the permanent stock, and acted on by a spring, of a sliding rag jaw, having a screw adjustment on or along the permanent stock for joint and independent action."

61. For an *Improvement in Vapor Lamps;* Joseph G. Gilbert, City of New York.

Claim.—"The combination of the sulphur and cork."

62. For an *Improvement in Metallic Packing for Pistons of Steam Engines;* George H. Corliss, Providence, Rhode Island.

Claim.—"The arrangement within a piston of the cylindrical springa."

63. For an *Improved Machine for Drying Grain, &c.;* Christian Custer, Philadelphia, Pennsylvania.

Claim.—"The rotating and vertically reciprocating drying chamber, formed of the series of vessels or pans and guide plates placed on the shaft, in combination with the furnace, drum, and hot air chamber, the above parts being arranged relatively with each other."

64. For an *Improved Mode of Tightening Tires of Carriage Wheels;* James M. Dick, Buffalo, New York.

Claim.—"The combination of the wedge and bolt, or their equivalents, with the felloes and tire."

65. For an *Improvement in Corn Shellers;* Andrew Dillman, Plainfield, Illinois.

Claim.—"In combination with an inclined trunk, the inclined carrying apron or belt with its lags."

66. For an *Improvement in Seed Planters;* I. W. Ells and James Charlton, Pittsburgh, Pennsylvania.

Claim.—"The combination and arrangement of the reciprocating feed slide, with the cut-off slats and the brush."

67. For an *Improvement in Mowing Machines;* George C. Dolph, West Andover, Ohio.

Claim.—"The lever, link, sliding box, and guides, with the adjusting wrist, and in relation to an adjustable cutter bar."

68. For an *Improvement in Cartridges for Breech Loading Fire Arms;* J. Durell Greene, Cambridge, Massachusetts.

Claim.—"The cartridge having the ball behind the powder, and a wad behind the ball."

69. For an *Improved Machine for Ramming Under the Cross-ties of Railroads;* Richard B. Harrison, Vicksburgh, Mississippi.

Claim.—"My movable machine for ramming earthy matter under the cross-ties of

railroads, said machine being composed of reciprocating rams and suitable actuating levers combined with a platform car."

70. For an *Improvement in Hand Seed Planters;* Joel Haines, West Middleburg, Ohio.

Claim.—"The opening through the standard, or its equivalent, so arranged as to form a bar or scraper to clear the earth or wet earth from the plunger as it is pushed down, and deliver it out through the opening, whether the upper edge of the scraper is curved or otherwise."

71. For an *Improvement in Straw Cutters;* Porter Hill and Charles E. Jones, Millport, New York.

Claim.—"1st, The combination of the rotating knife or cutting disk, with the series of revolving chambers arranged around a central shaft or axis, in such a manner that the revolutions of the same shall bring the straw in each successively between the edge of the knife and periphery of the chambers. 2d, The manner of feeding the straw to the knife by means of the eccentric, the permanent and movable ratchet bars, and dogs so arranged as to crowd the straw forward only when the chamber, by descending, is clear of the action of the knife, and also be capable of adjustment to different degrees of feed."

72. For an *Improvement in Attaching Wires to Bell Telegraphs;* Henry Hochstrasser, Philadelphia, Pennsylvania.

Claim.—"The intermediate spring, or its equivalent."

73. For an *Improvement in Corn Planters;* D. W. Hughes, New London, Missouri.

Claim.—"Connecting the two implements together by means of the plates, and bars, and pendent bar."

74. For an *Improvement in Machines for Punching Paper Fillets for Transmitting Telegraphic Signals;* John P. Humaston, New Haven, Connecticut.

Claim.—"1st, The manner of operating the punches for perforating the characters in the paper, consisting of the revolving type-wheel, or other equivalent means of indicating characters, in combination with the punches. 2d, The method of regulating the feed of paper, consisting of the graduated stop-wheel, or equivalent series of stops, in combination with the type-wheel, and with the means for propelling the paper fillet past the punches. 3d, The manner of forming the cutting ends of the punches, that is to say, having its advancing end formed into two cutting edges by means of the V shaped recess, in combination with a second pair of cutting edges opposite to them, formed in like manner and upon the same plate, but in position at a right angle to the first pair, thus making the other half of the shear, in conjunction with an adjoining punch."

75. For an *Improvement in Automatic Railroad Car Brake;* W. R. Jackson, Baltimore, Maryland.

"This invention consists in the mode of arranging the actuating parts of the brake, so that when the car is being drawn forward, the brakes shall be thrown out of action and leave the wheels free to revolve; but when the tractive force ceases to be applied, the brakes will instantly be brought into action, and check the speed of the train or vehicle."

Claim.—"The mode of controlling the action of the spring or springs, which bring the brake blocks to bear upon the tread of the wheels by the operation of the tractive force, or its suspension, so that the wheel shall be free when the vehicle is being drawn forward or backed, and the brakes applied by the momentum of the train, when the tractive or backing force is withdrawn."

76. For an *Improvement in Sheep Shearing Machines;* J. V. Jenkins, Jackson, Michigan.

Claim.—"Connecting together the two shafts, and also the shaft to the cam shaft by universal joints, the connecting joint of the shaft being provided with guards, and connecting the upper end of the shaft by a joint to the slide on the swinging bar."

77. For an *Improvement in Machines for Lasting Boots and Shoes;* John Kimball, Boston, Massachusetts.

Claim.—"Combining the toe-rest and its clamp to the attachment plate by means of an inclined rod, so that both may be moved together, in order at one and the same time to clamp the upper to the toe of the last, and move the toe-rest towards the heel post."

78. For an *Improved Wear Iron for Carriages;* I. George Sefter, Philadelphia, Pa.

Claim.—"The peculiar construction of the metallic recess guards, with the flanches bearing against the bottom and sides of the body of a plain carriage or wagon, and arranged with the latter."

79. For an *Improved Bolt for Safes;* Stuart Perry, Newport, New York.

Claim.—"So combining a safety bolt with the lock of a bank, vault, store, or other door, through the means of a bar or trigger, as that the forcing of the lock by any means from the door, shall trip or release the safety bolt, and allow it to securely fasten or lock said door."

80. For an *Improvement in Scythe Snaths;* Abner H. Pinney, Columbus, Ohio.

Claim.—"Uniting the two pieces by a branched ferule for the purpose of making a scythe snath that shall have the proper form without being bent into that shape, and the necessary strength and rigidity to make it an economical implement."

81. For an *Improvement in Signals for Steamboats;* Albert Potts, Philadelphia, Pennsylvania.

Claim.—"The system of signals for steamers, formed by lights mounted upon movable cranes, and rotated from the paddle wheel or propeller shaft."

82. For an *Improvement in Wash Mixtures for Woolens, &c.;* Wm. Reisig, Astoria, New York.

Claim.—"An aqueous saponaceous composition, with the alkalies in excess."

83. For an *Improved Mortising Chisel;* John A. Scroggs, Burlington, Vermont.

"My invention consists in constructing a mortising chisel, in such a manner that the chip formed by the forward movement of said chisel will be thrown out of the mortise by the reverse movement of the same."

Claim.—"My improved self-clearing mortising chisel, whose peculiarity consists mainly of its oblique grooves."

84. For an *Improvement in Locks;* John P. Sherwood, Fort Edward, New York.

Claim.—"The improvement in locks produced by so shaping and arranging the bolt and the tumbler of a lock, that the said tumbler is enabled to retain the bolt within reach of the arms on the knob shank follower, when it is used as a spring latch bolt, and also retain the said bolt in a position beyond the reach of said arms, when it is thrown outwards by the key into a position to serve as a lock bolt. Also, as the second feature of my invention, the combination of the lever shank with the tubular pivot and the tumbler, in such a manner that it may be made to firmly lock the tumbler in such a position as to protect the bolt from any action of the key, and thereby prevent the locking or unlocking of the bolt."

85. For an *Improvement in Grinding Mills;* Wm. Stauffer, Middlebury, Indiana.

Claim.—"The combination and arrangement of the arm with the arm, and the sliding rod together, with the cam on the shaft, the beam, the rod, the weight, and the connecting beam, for the purpose of arresting the motion of the mill. Also, the arrangement of the cord with the shaft and the springs, for the purpose of ringing the bell to notify the attendant when the grain is nearly run out of the hopper."

86. For an *Improved Door Spring;* Edward P. Torrey and Wm. B. Tilton, City of New York.

"The object of our invention is to render practicable and useful the adjusting bracket of the upright torsional rod spring, contrived by T. Riggin, said bracket consisting of a turning socket with a flanch at its upper end, in which flanch a series of adjusting holes are formed."

Claim.—"The arrangement of the adjusting cog-wheel between the two notched

ears of the bracket, and the pivoted stop plate on the face of the bracket, and in such relation to said cog-wheel and the notches in the ears, that the whole operating together will form a firm and substantial adjusting device for the upright torsional rod spring."

87. For an *Improvement in Churns;* Daniel E. True, Lake Village, New Hampshire.

"This invention consists in providing the rocking or other churns having a similar operation, with a separator, for the purpose of dividing the cream into two separate currents, and allowing them to come in contact alternately."

Claim.—"The employment (in the rocking and other churns of similar operation,) of a separator."

88. For an *Improvement in Brick Machines;* Stephen Ustick, Philadelphia, Pa.

Claim.—"The oscillating filling box with projections at its ends, in combination with the condensing mould having depressions at its ends, when said parts are constructed and arranged to operate in relation to each other, and in connexion with the pistons."

89. For an *Improvement in Blast Furnace;* Samuel Wilkes, Hammondsville, Ohio.

Claim.—"The introduction and application of steam in blast furnaces at the boshes, whether at one or more points."

90. For an *Improvement in Washing Machines;* Philip N. Woliston, Springfield, Ohio.

Claim.—"The auxiliary rubber disk, in combination with the disk provided with cleats or rubbers on both sides, and the cleats on the bottom of the tub."

91. For an *Improved Padlock;* Linus Yale, Newport, New York.

"This invention consists in attaching two pieces of metal together by a tongue and groove, in such a manner that by sliding back and forth they will open and close a suitable hole to receive the staple."

Claim.—"The use of the tongued and grooved sliding joint, operating in concert with the jointed stops."

92. For an *Improved Method of Manufacturing Wooden Wash-boards;* L. B. Batcheller, Assignor to West, Canfield & Co., Arlington, Vermont.

Claim.—"The machine."

93. For an *Improvement in Saccharine Evaporators;* Joseph Bour, Forbach, France, Assignor to Charles Parlange, Parish of Point Coupie, Louisiana.

Claim.—"The combination of a series of hollow vessels, with apparatus on the interior thereof for raising the water to and passing it off by the central axis, and the further combination of such like surface, with vessels or apparatus for raising the liquid to be evaporated, and distributing the same over the exterior of the revolving surfaces."

94. For an *Improvement in Harvesters;* C. M. Sufkin, Assignor to Norris Sufkin, Unity, New Hampshire.

Claim.—"The combination of the cutters, cord, with the peculiarly constructed plate."

95. For an *Improvement in Cultivator Teeth;* Edmund L. Freeman, Brownville, Assignor to self, and J. and G. Lord & Co., Watertown, New York.

Claim.—"A lapped-headed cultivator tooth. Also, a brace washer and stay-pin, in one piece, underneath the head."

96. For an *Improvement in Machines for Pegging Boots and Shoes;* Seth D. Tripp, Winchester, Assignor to self and Luther Hill, Stoneham, Massachusetts.

Claim.—"1st, In machines for pegging boots and shoes (when the gate which carries the awl and driver is allowed to swing freely in a plane perpendicular to the surface of the sole, or nearly so,) is the arrangement and combination of the spring, the disks, lever with its toggle-joint and connecting rod, and the lever, for the purpose of bringing down, clamping, and releasing the gate. 2d, The feeding pawl with its spring and slot, in combination with the holding pawl or bolt, whereby the amount of feed of the carriage is regulated, and the latter is held stationary. 3d, Regulating the motion of the carriage by means of the combination of the following devices, or their substantial

equivalents, viz: the groove, pin, dogs, stops, blocks, and guide. 4th, The combination of the devices employed for the purpose of cutting off a portion of the pegs, and for adjusting the throw of the awl and driver to correspond therewith, or their substantial equivalents, whereby the awl and pegs are prevented from penetrating the last. 5th, The offsets upon the slides for the purpose of causing the driver to descend over the hole made by the awl."

97. For an *Improvement in Extension Gas Tubes;* Charles Monson, New Haven, Connecticut.

Claim.—"The combination of levers and tube or tubes. Also, the use and application to a gas tube of jointed extension levers. Also, the use and application thereof, as an instrument for extending the reach, and contracting the reach of a gas tube, or of gas tubes, of whatever form, and for holding and guiding the same. And, finally, the use of said levers as an instrument for relieving or preventing the strain of traction or of weight upon said gas tube, and upon the joints thereof."

98. For an *Improved Sash Lock;* Wm. Patton, Towanda, Pennsylvania.

"This invention consists in the independent hook and lock upon the same axle, so that they may be changed to form a right or left hand-catch as may be desired."

Claim.—"In combination with the single axle, the self-locking hook, and self-acting double hook fastener, so arranged as to act independently of each other, and so that they may be shifted on said axle to form a right or left hand-catch."

99. For an *Improved Machine for Forging Nuts;* Edward Pay and Samuel Hall, City of New York.

Claim.—"The hammering apparatus, in combination with the punch, and the punch arranged and operating for making nuts."

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100. For an *Improvement in Machines for Hulling Rice;* Wilson Ager, Rhorsburg, Pennsylvania.

Claim.—"Removing the rice husk by pressure in direction of the length of the grain, effected by the action of a shell and burr."

101. For an *Improvement in Machines for Cleaning Rice;* Wilson Ager, Rhorsburg, Pennsylvania.

Claim.—"The method of cleaning rice by submitting the mixture of grain and husk resulting from the hulling process, to an alternate packing and loosening action."

102. For an *Improvement in Grinding Mill;* Aaron Arnold, Troy, New York.

"This invention relates to the grinding apparatus of the mill, and consists in the cut or sectional cone, and in connexion therewith, the disk, and their arrangement on the shaft, so as to be readily removed and replaced by others when worn out."

Claim.—"The combination of the rotating disk or plate, and cut or sectional cone, with the interior of the concave and flanch, for the purpose of feeding in to the mill, and grinding large substances, such as corn on the cob. Also, securing the cone and disk or plate to the shaft, through the intervention of the face plate, so that said cone and disk may at any time be removed and replaced by others, when they become dull or worn away."

103. For an *Improvement in Flour Bolt;* N. Baumann, Elmore, Illinois.

Claim.—"The shell or case, curved or formed, in combination with the rotating beaters and frame, with bolting cloth attached."

104. For an *Improvement in Machines for Kneading Dough;* Hiram Berdan, City of New York.

Claim.—"The employment in a kneading machine of a hopper."

105. For an *Improvement in Machines for Hardening Hat Bodies;* Joseph Booth, Newark, New Jersey.

Claim.—"A hardening machine consisting substantially of a cradle and of a rapidly revolving spindle, upon which the cradle is supported eccentrically."

106. For an *Improved Mode of Sustaining Window Sash;* Edward T. Briggs, Salem, Massachusetts.

"This invention consists in providing the sash with a metal strip to slide in an angular grooved support, operated upon by a spring, and causing a friction sufficient to sustain the sash at any desired height it may be placed."

Claim.—"Furnishing the sash with the metal strip, in combination with the angular grooved support and spring."

107. For an *Improvement in India Rubber Paint;* William and William A. Butcher, Philadelphia, Pennsylvania.

Claim.—"The composition prepared and composed of the materials, for the purpose of making water-proof paint."

108. For an *Improvement in Gas Generators;* John Butler, Brooklyn, New York.

Claim.—"Generating illuminating gas in a retort over the surface of melted lead or other fusible metal."

109. For an *Improvement in Excavators;* Ze Butt, Lincolntown, North Carolina.

Claim.—"The attaching the posts, in combination with the cross-bar resting upon the frame, to the scoop itself by pivots or otherwise, for the purpose of bearing and supporting it whilst loading and regulating the depth it is to enter the ground, and for taking the strain off the chains and windlass. Also, the elevation of the loaded excavator by horse-power, or any other method substantially the same. Likewise, the arrangement and combination of the gate catch rod and lever, so that the gate can be opened and closed by the driver, without his leaving his seat."

110. For an *Improvement in Mastic Roofing;* Wm. H. Carver, Covington, Kentucky, and J. Beckley, Cincinnati, Ohio.

Claim.—"The precise manner employed of mixing and compounding the ingredients, and applying the cement when combined with the proportions of ingredients, by which process of mixing and compounding, and combination of ingredients, and applying the cement to use, we are enabled to decompose or destroy the ammonia contained in the coal tar, to prevent it from destroying the cement and eating the canvass on which it is spread, and at the same time produce a cement that is not brittle and subject to cracking, but hard enough to resist forces that roofs are generally subject to, and at the same time elastic enough to expand and contract to suit all conditions of heat and cold, and make the cement water-proof."

111. For an *Improvement in Mowing Machines;* A. H. Caryl, Sandusky, Ohio.

Claim.—"The combination of the rear portion of the tongue or hounds with the main or wheel frame and seat, said parts being arranged for joint operation."

112. For an *Improved Raking Attachment for Reaping Machines;* A. H. Caryl, Sandusky, Ohio.

Claim.—"1st, Raising the rake in the plane in which it is inclined. 2d, Operating the raking attachment back and forth over the platform, by means of the mechanism. 3d, Inclining the rake from a vertical plane to correspond with the length of the grain being cut."

113. For an *Improvement in Invalid Beds;* George H. Clark, Pontiac, Michigan.

Claim.—"The construction and arrangement of parts, by which the head end of the foot portion of the bed is made capable of being lowered away from the patient. Also, combining with said arrangement the slide attached to the frame to support the vessel."

114. For an *Improvement in Making Paper Pulp from Ivory;* Wm. N. Clark, Chester, Connecticut.

Claim.—"The using of ivory as stock to make pulp for the manufacture of paper."

115. For an *Improvement in Hanging Mill Stones;* Edwin Clark, Lancaster, Pa.

Claim.—"So uniting the rim which supports the upper stone to the frame of the mill, by sliding blocks or followers, as to allow an upward play or automatic adjustment of the upper stone, and at the same time admit the usual hand adjustment by set screws if desired."

116. For an *Improvement in Ships' Pumps;* Abraham Coates, City of New York, and Samuel M. Perry, Brooklyn, New York.

Claim.—"The peculiar mechanism by which we obtain reciprocating motion between the pump and piston, from each move of a lever having a combined horizontal and longitudinal motion, the same consisting of the shaft, the cross through which it passes, the universally moving lever attached by journals to the cross at right angles to the shaft, and the two bevel gears or section of gears, the one attached to the lever, the other to the shaft, or any other arrangement substantially the same."

117. For an *Improved Socket for Bolts;* H. W. Collender, City of New York.

Claim.—"Having a disk or follower placed within the socket and connected with a spring, arranged in any proper way, so that as the bolt is withdrawn from the socket, the spring will press the disk or follower against the upper or outer end of the socket, and close the orifice thereof."

118. For an *Improved Machine for Expanding Spectacle Bows;* George N. Cummings, Hartford, Connecticut.

Claim.—"The spectacle eye former, made in two parts, the circumference of the two parts when closed being smaller than the eye, and being expanded by the double former to the required size."

119. For an *Improvement in Street Sweeping Machines;* John Critcherson, Boston, Massachusetts.

Claim.—"The improvement in street sweeping machines, which consists in the combination of the adjustable sliding bars traveling in the arc of a circle with the universal joints for driving the diverging shafts upon which the bushes are arranged, whereby the sweeping apparatus is adapted to streets of various widths."

120. For an *Improvement in Bridges;* Charles H. Earle, Green Bay, Wisconsin.

Claim.—"The supporting of those ends of the several sections of the bridge which are not connected directly with the abutments, by attaching them to cap pieces, or their equivalents, fitted to rise and descend on piers, in combination with the attachment of the sections next the abutments with knuckles or hinges, whereby the bridge is rendered self-adjusting, and prevented being carried away by accumulations of ice, floods, or other causes leading to lift the bridge from its place."

121. For an *Improvement in Operating Valves of Steam Engines;* Robert H. Fletcher, Brooklyn, New York.

Claim.—"The arrangement of the slide valve with the pistons and valves, with their respective steam ways operating together."

122. For an *Improved Painters' Easels;* George Gillett, Little York, New York.

Claim.—"The combination of the three motions obtained by the two semi-circles, and the rotary motion of the standard, together with the latches and notches in the semi-circles to retain the position, and also as an application to the easel or painting stand."

123. For an *Improvement in Safety Fuse Compositions;* Edwin Gonez and Wm. Mills, City of New York.

Claim.—"The explosive compound for safety trains, fuses, and similar purposes, formed of the ingredients."

124. For an *Improved Mode of Operating Window Sash;* John C. Grant, Salem, Mass.

Claim.—"Combining with the window frame and sash, the rack, gears, pulleys, and spring."

125. For an *Improvement in Coolers for Breweries;* Adolph Hammer, Reading, Pa.

Claim.—"The application thereto of the movable partitions rendered stationary."

126. For an *Improvement in Feathering Paddle-wheels;* Lewis T. Howard, Smith's Mills, Mississippi.

Claim.—"Contracting the hub of the paddle-wheel so as to dispense with an outside bearing, for the purpose of enabling me to place the feathering-wheel outside of the paddle-wheel, and use any length of connecting arms between said feathering-wheel and the buckets that may be deemed most effective."

127. For an *Improvement in Treating Cotton and Linen Waste;* Eben Norton Horsford, Cambridge, Massachusetts.

Claim.—"The use of acid to dissolve metallic particles in cotton and linen factory waste."

128. For an *Improved Method of Treating Fibrous and Textile Substances in a Vacuum for Cleansing purposes;* Julius A. Jillson, Poughkeepsie, New York, and Henry Whinfield, City of New York.

Claim.—"The process of treating fibrous and textile substances in a permanent vacuum for extracting coloring grease, or other foreign matter."

129. For an *Improved Machine for Pointing Wire;* C. Jillson, Worcester, Mass.

Claim.—"Causing the wire that is being pointed to force the cutter away from the point that is being cut, but in forcing it away, controlled by a pattern which regulates the form and the taper given to the wire."

130. For an *Improved Belt Tool;* David A. J. Lamson, Cherry Valley, Mass.

Claim.—"The combination of the several tools in one instrument."

131. For an *Improved Spoke Machine;* Samuel Lord, Perry, Georgia.

Claim.—"The vibrating frame, operated and arranged with the carriage and saw, so as to operate conjointly."

132. For an *Improvement in Harness for Looms;* George Matoon, Chickopee Falls, Massachusetts.

Claim.—"The mode of making a harness so that its lease and knot shall be below its eye, and the threads of each loop be caused to pass against one side of their shaft or bar, instead of being caused to embrace opposite sides of it, namely, first knitting the harness with a lease at top and one at bottom, or one above, as well as one below each eye, and subsequently changing the upper shaft so as to pass it between the several loop threads of the upper side of the harness, in such manner as to make both threads of each loop pass against one side of the shaft."

133. For a *Composition for Preparing Tracing Muslin;* Jesse K. Park, Marlborough, New York.

Claim.—"The employment of the oil of the palma christi, or castor oil, alone or as an ingredient in a composition for increasing the transparency of tracing muslin."

134. For an *Improved Method of Regulating the Velocity of Wind-wheels;* Francis Peabody, Salem, Massachusetts.

Claim.—"An improvement in regulating the action of wheels."

135. For an *Improvement in Valve Gears for Oscillating Steam Engines;* John C. Pennington, Paterson, New Jersey.

Claim.—"A valve gear for an oscillating steam engine composed of an eccentric and a slotted arc, the curve in which is concave towards the shaft, and provided with a sliding pin which is connected with the valve, or the equivalents thereof, and this I claim whether the slot be long enough for reversal. or of such length as may be sufficient for running the engine in one direction only."

136. For an *Improved Tenoning Machine;* Perry Putnam and John E. Crane, Lowell, Massachusetts.

Claim.—"We do not claim the parts of our machine separately, but their arrangement and operation specifically."

137. For an *Improvement in Watch-makers' Lathe;* Boswell H. St. John, Bellefontaine, Ohio.

Claim.—"The construction of the chuck, formed of the jamb disk, the tubular clutch collar or ward brush, with the centering plate and adjustable jaws together, combined with a keying mandrel."

138. For an *Improvement in Boxes for Preserving Alkalies;* George Thompson, East Tarentum, Pennsylvania.

Claim.—"The use of metallic boxes, constructed and united with infusible cement,

for the purpose of putting up the caustic alkalics of soda and potassa in small quantities,"

139. For an *Improvement in Drip Pots for Sugar Houses;* John Turl, City of New York.

Claim.—"Constructing the pot of two metal parts or halves formed or 'stuck-up,' in proper shape by any proper means, and connected together by rivets, by brazing, or in any suitable way."

140. For an *Improvement in Illuminating Gas Apparatus;* Charles B. Warring, Poughkeepsie, New York.

Claim.—"1st, The eye-piece and tube in combination. 2d, The peculiar apparatus for conveying the gas into the gas holder."

141. For an *Improvement in Ball Cartridges;* Lemuel Wells, Astoria, New York.

"This invention consists in making the shell of a ball cartridge of a piece of hard metal tube, fitting into a seat swaged, or otherwise, prepared to receive it inside the bullet, by which construction several advantages are obtained."

Claim.—"The attachment of the hard metal shell of a ball cartridge to the bullet, by making it smaller than the bullet, and driving it into a cavity in the rear of the bullet."

142. For an *Improvement in Diaphragms for Photographic Cameras;* J. Robert Werner, City of New York.

Claim.—"The application of an elastic diaphragm in photographic cameras."

143. For an *Improvement in Brewers' Coolers;* Adam Wood, Pittsburgh, Penna.

Claim.—"Constructing the coolers in two parts, corrugated and placed in contact, so that cold water or air passages are formed between said bottoms, and the bottoms allowed to expand and contract freely without injury, by which the bottom of the liquor within the cooler may be cooled as quickly as the top, or the heat rapidly absorbed from both surfaces, and the cooling of the whole mass or quantity therefore greatly expedited."

144. For an *Improved Raking Attachment for Reaping Machines;* Christian Yost, Leacock, Pennsylvania.

"This invention is giving the rake a downward and quick motion as it reaches the platform by means of mechanism constructed and arranged in a peculiar manner."

Claim.—"Operating the rake by means of the device, the regulator, in combination with the semi-cog-wheels and pins."

145. For an *Improved Type-setting and Distributing Machine;* Timothy Alden, City of New York.

"My invention of improvements in type-setting and distributing, consists in a machine partly automatical in the operation, and partly operated by the action of an attachment. The purely automatical part lies in the type-distributing operation, while the setting of type is governed by the attendant. Both setting and distributing may be going on at the same time, or separately."

Claim.—"1st, The method for conveying the type to and from the type cases, and the composing and setting tables, consisting of a type-carrier, in combination with a series of conveyers, which are capable of receiving any type indiseriminately, and also of receiving an indication representing the type so received, or that required, whereby that type may be deposited into, or taken from, the type cases. 2d, The method of attaching the conveyers to the carrier, by which they are permitted to stop while delivering or receiving type without arresting the motion of said carrier. 3d, Giving to the conveyer a vibrating or tilting motion upon its central pin, whereby its gripping end is made to closely approach the place at which the conveyer is to receive or deposit a type. 4th, In combination with the devices or mechanism for receiving and for delivering the types into, and from, the type cases, or their equivalents, arranging the types edgewise in said cases, whereby for all the types of a font, an uniform throw or action may be given to said mechanism. 5th, In combination with the type channels, the mechanism for pushing out the type, consisting of the rack, pendulum, lever, and propelling rod, and the pusher upon the conveyers, or any equivalents thereof. 6th, In combination

with the type channels, the mechanism for preventing the stopping of a setting conveyer at a type channel when it is empty, or a distributing conveyer at a channel when full of type, consisting of the tilting bar, the pendulum, lever, and rack, or equivalents. 7th, The method of discharging the type from a distributing conveyer into the type channels, or of causing it to be received from such channel into a setting conveyer, consisting of the cam and the pusher-plate, or equivalents thereof. 8th, The mechanism for setting the gripping bolt upon the conveyers, and for releasing the same, consisting of the stationary cam and crank lever, for the setting of said bolt, and for the releasing thereof of the latch and cam or pin. 9th, The method of effecting or insuring the deposit of each type into, or the taking thereof from, an appropriate case, consisting of the excavated ring, or any equivalent thereof, which shall have upon it, at or near each type case, a device indicative of the denomination of the type contained in said case, and which device shall cause, at the proper place, an action of the conveyer to receive or to deposit a type as the case may be, in accordance with any given set upon the conveyer. 10th, The stationary inclined pieces, in combination with the grooves of the ring, for restoring the indicating points upon the conveyer to a zero or starting point. 11th, The movable indicators, or their equivalents, in combination with the grooves in the ring, and with the shifting bars of the distributing mechanism. 12th, The method of setting the distributing indicators by means of the system of levers, or equivalent mechanism, so constructed and operated as to be acted upon by a system of nicks upon the type, by which certain parts are allowed to be brought into operation to move the indicators in accordance with the plan or combination of nicks, and whereby the appropriate case or place of deposit of type is indicated upon the conveyers. 13th, The graduated stop, in combination with the indicating levers for regulating the feed of the line of type, and also in combination therewith the mechanism for restoring said levers into position when about to return for a new setting, and for setting the frame against its guide plate. 14th, The arrangement of mechanism for transmitting the movements produced upon the levers by the nicks in the type, and for effecting the proper combinations upon the indicators, consisting of the detaining levers, the bars, and the connecting levers, together with the operating cams upon the shaft, or any equivalent combination, whereby the same results will be produced. 15th, The mechanism for feeding up the column of type, and for elevating the successive lines thereof into the channel, or equivalent devices. 16th, The method of engaging and disengaging the feeding pawls, consisting of the hanging lever, in combination with the frame with the means for depressing the bolt, and with the ratchet having the engaging and disengaging wedges. 17th, In combination with the keys, the arrangement of mechanism whereby the separate different signals represented by each of a great number of keys may be produced by a less number of indicators. 18th, The radially revolving registering levers, in combination with the register wheel, and with the keys, or the equivalents thereof. 19th, The independent registering apparatus, or its equivalent apparatus, which will effect the recording of the letters or signs, as indicated by the keys, independently of the type carrying apparatus. 20th, The mechanism for transmitting the indicators from the register, consisting of the detaining levers, or equivalents, in combination with the setting indicators, and with the register. 21st, So combining the register and the setting indicators with the type-carrier, that the latter shall effect the movements of the register, to set the indicators in time to act upon the setting conveyers, and immediately thereafter effect the retreat of the said indicators previous to the passage of a distributing conveyer."

146. For an *Improved Method of Manufacturing Shingles;* James E. Young, Augusta, Maine.

Claim.—"Vibrating the shingle bolt about an axis lying in or near the plane of the cut, and equally distant from each end of the bolt. Also, the sliding rod and wedges."

147. For an *Improved arrangement of Means for Reefing and Furling Sails:* George W. La Baw, Jersey City, N. J., Assignor to self and Charles A. Durgin, City of New York.

Claim.—"The arrangement of vertical rollers in front or rear of the mast, and operated by mechanism from the deck of the vessel, and whereby I am enabled to operate separately or together the sails on each mast from the deck, irrespective of the mechanism employed for working the vertical rollers."

148. For an *Improved Saw Filer;* Jasper J. Near, Oneida, Assignor to Eli Near and Levi Vandusen, Madison Co., New York.

Claim.—"A clamp to gripe the saw and carrying hinged vibrating arms, provided with springs for holding and operating the file."

149. For an *arrangement of Passages and Means for Working Steam Valves by the direct action of Steam:* Barnabus Ruberts and Alexander Crumbie, Assignors to selves and John Benson, Brooklyn, New York.

"This invention consists in so arranging and working the valves, that we are enabled to make a simple and economical engine."

Claim.—"The arrangement of the steam channels, which are opened and closed by the travel of the main piston, connecting the steam chest and cylinder, in combination with the pistons of equal areas, or their equivalents."

150. For an *Improved Mode of Controlling Cog-gear Sash Balance;* John McMurtry, Lexington, Assignor to Daniel Wiehl, Fayette Co., Kentucky.

Claim.—"Arranging the cog-gears of the lower sash on the shaft which is capable of turning vertically and sliding horizontally, and which has arranged on its back end a locking plate, which slides with it, but which cannot turn with it, said plate having a bur or cog on its edge, which serves as a stop to hold both or either of the sashes in any desired position when geared together or separately."

151. For an *Improvement in Brick Machines;* George J. Washburn, Assignor to self and Anson L. Hobart, Worcester, Massachusetts.

Claim.—"The combination of the moulds of the frame and hopper, constructed, arranged, and operating together."

152. For an *Improved Boot and Shoe Sole Cutter;* Parker Wells, Middletown, Assignor to Samuel Mower, Boston, Massachusetts.

Claim.—"The combination of a cutter or cutters, with a yielding slide."

153. For an *Improvement in Locks;* H. W. Covert, Roxbury, New York.

Claim.—"The combination of the disks with the cones, cylinders, or disks."

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154. For an *Improved Cutting Apparatus for Grain and Grass Harvesters;* John W. Baltzly and Wm. Hobson, Pana, Illinois.

Claim.—"The reciprocating teeth, in combination with the stationary cutting plates in the fingers."

155. For an *Improvement in Gas Burners;* Wm. W. Batchelder, City of N. York.

"My improvement in gas burners or jets, is a superior method of burning illuminating gas, whereby greater economy is obtained in the consumption, as well as a superior quality of light."

Claim.—"The improved method of burning gas, viz: combining two apertures of different areas, so arranged that a flat stratum of gas issuing in the first instance from the lesser aperture, shall impinge and press upon the second and larger aperture placed in the same plane with the issuing jet, and in such manner as to pass it without causing any deviation thereof."

156. For an *Improved Machine for Binding Grain;* Joseph F. Black, Lancaster, Ill.

Claim.—"The combination of the arms and hooks or clamps, constructed and arranged to operate conjointly."

157. For an *Improvement in Horse Powers;* George G. Burt, Abram and George F. Wright, Harvard, Massachusetts.

Claim.—"The method by which we are enabled to unerringly give such a shape to the ends of the tracks of said machine, that closely fitted platform chains may be operated upon them without producing any variation of tension or irregularity in the movements of said chains."

158. For an *Improvement in Life Boats;* Mortimer M. Camp, New Haven, Conn.

Claim.—"1st, Dividing the hold of a life boat into sections by the bulkhead, and

having an aperture in the bulkhead to be covered and closed by the swing hatch. 2d, Making the section of the hatch to operate as a cover or valve to close the aperture in the bulkhead. 3d, The combination of the movable combings with the hatch and the aperture in the bulkhead."

159. For an *Improvement in Bearings for Mill-stone Drivers;* Edwin Clark, Lancaster, Pennsylvania.

Claim.—"The rocking bearing consisting of a cylindrical portion inserted within a cavity in the bearing block, and a wing portion passing through a slot in said bearing block, in combination with the bearing recess in the driver."

160. For an *Improvement in Metallic Packing Rings for Steam Engines;* Patrick Clark, Rahway, New Jersey.

Claim.—"Constructing packing rings of a number or series of layers or lamina of sheet metal, for the purpose of securing that flexibility necessary to enable me to bend around a rod a metallic ring having a sufficient quantity of material in it to insure the requisite durability."

161. For an *Improvement in Burglars' Alarms;* Simeon Coon, Ithaca, New York.

Claim.—"The combining the spring and hammer in one piece, and acting on a stirrup."

162. For an *Improved Edge-plane for Trimming Boot and Shoe Soles;* Isaac A. Dunham, North Bridgewater, Massachusetts.

Claim.—"The new sole or welt trimmer constructed with a cutting blade and guard that together form a circle or very nearly, and with the cutter so arranged as to be set up to its guard as fast as it becomes worn, by simply turning the said cutter on its centre."

163. For an *Improvement in Reaping and Mowing Machines;* John G. Dunham, Raritan, New Jersey.

"This invention consists in so arranging and constructing the outer end of the sickle beam, that it can be sustained at different heights by the use of a single wheel, and thus both ends of the sickle beam be kept on a level with each other."

Claim.—"In combination with the rear part of the rectangular frame, the supporting castor wheels, with the inclined sliding frame and arms, adjustable brace, and inclined bar, furnished with a series of sockets."

164. For an *Improvement in Port-folio or Music Stands;* Augustus Eliaers, Boston, Massachusetts.

Claim.—"Arranging the braces or sliding frames which are hinged to and support the adjustable leaves of a port-folio stand, in such a way that they shall in sliding always keep in nearly a vertical position, for the better supporting the leaves and the weight upon them, by having the traversing and bolting rods move in curved grooves directly beneath them in the sides of the stand, instead of having the bolting rods of each brace or frame slide in grooves on the other or opposite side of the centre of said stand, in combination with the locking devices for the purpose of rigidly locking and supporting the leaves, and whereby the whole stand can be lifted by the leaves in removing it from place to place."

165. For an *Improvement in Harvesters;* Andrew B. J. Flowers, Greenfield, Ind.

Claim.—"Guiding the machine by means of the castor wheels, upright shaft, and the horizontal shaft, in combination with the peculiarly constructed castor plates, said parts being arranged to operate in relation to each other."

166. For an *Improvement in Steam Heating Apparatus;* Edmund Gibbs, Madison, Wisconsin.

Claim.—"The boiler with its trough, operating in combination with the coil of pipe and its prongs, or their equivalents."

167. For an *Improved Apparatus for Loading Logs on Wagons;* Philander Gilbert, Alexandria, Ohio.

Claim.—"The peculiar construction and arrangements of the portable frame, when combined with a windlass and its appurtenances, capable of being shifted to either side of a wagon."

168. For an *Improvement in Locks;* Joseph L. Hall, Cincinnati, Ohio.

Claim.—"1st, The construction and arrangement of tumblers in connexion with the block and back plate, the whole serving as a screen or curtain between the key-hole and the more interior parts. 2d, The construction and arrangement of bit, lever, and tumblers, whereby the bolt is held securely to its locked position, until the withdrawal of the key. 3d, The combination of the bit, dog, and arm, for the purpose of tightening the spring."

169. For an *Improvement in the Process of Making White Lead;* Henry Hannen, Dubuque, Iowa.

Claim.—"Subjecting the lead and compounds formed therefrom by the agents employed for this purpose to the action of steam and air, vapor of acetic acid, and carbonic acid gas, alternately and successively, until the process is complete."

170. For an *Improved Safety Clasp for Bracelets, &c.;* Isaac Hermann, City of New York.

Claim.—"The application of the two inclined plane surfaces and the plate attached to rod, to secure more safely clasps on bracelets, and for other purposes. Also, the combination of the steadying plate, which plate prevents the catches from turning aside; the whole is in combination, that is, plate, inclined planes, and rod."

171. For an *Improvement in Stirrups for Riding Saddles;* Dr. James Neil, Yorkville, New York.

Claim.—"The extension piece or lever, arranged and applied to the stirrup, so that when the rider falls, his foot if it remain in the stirrup shall operate the said extension piece or lever, so as to free one end of the bar, and thus release the stirrup from the stirrup strap."

172. For an *Improved Sleeve Fastener;* David C. Peacock, Brooklyn, New York.

Claim.—"The construction of a sleeve button secured by a bar affixed thereto at one end by a joint or hinge by passing through holes in the sleeve, and being secured or fastened at the end opposite to the affixed end."

173. For an *Improvement in Journals of Axles with Friction Rollers;* George A. Prentiss, Cambridge, Massachusetts.

Claim.—"The securing journals applied to the solid axle and friction rollers."

174. For an *Improved Hand Stamp;* T. J. W. Robertson, City of New York.

Claim.—"The construction of hand stamps."

175. For an *Improved Machine for Filing and Setting Saws;* Ansley C. Smith and Joseph K. Creighton, East Birmingham, Pennsylvania.

Claim.—"The combination of the filing, setting, and feeding device, when the whole is arranged to operate conjointly and automatically."

176. For an *Improvement in the Mode of Connecting and Disconnecting the Blocks of Iron or other Pavements;* Barzillai C. Smith, Burlington, New Jersey.

Claim.—"The mode of locking the plates or blocks of iron pavements, the same consisting of the locking bar and grooves, one of which is of sufficient depth to cover the entire width of the bar, while the other is of half that depth; and in combination therewith, I claim the grooves."

177. For an *Improvement in Railroad Car Seats;* J. H. Swan, City of New York.

Claim.—"The combination of the reversible back and seat, by means of the lever. Also, in combination of the levers, arms, and segment, with their attachment for reversing the back."

178. For an *Improvement in the Trussed Bridge;* Abram S. Swartz, Buffalo, New York.

Claim.—"The arrangement of the parts so that the tower, the tension bars, and the suspension rod, when taken together will present the distinctive feature of a triangle, with the foot of the arch resting upon the tower within the triangle."

179. For an *Improved Carriage Prop;* Chauncey Thomas, West Newbury, Mass.

Claim.—"My improved carriage prop as constructed with a screw shoulder cap, com-

bined with a joint bar standard, and arranged between the leather and the joint bars, and so as to screw upon the said standard."

180. For an *Improvement in Rotary Steam Engines;* D. C. Turner, Aztalan, Wis.

Claim.—"The valve in its recessed seat, and the protuberant rim, as arranged with the steam channels, floating abutments, and hinged pistons."

181. For an *Improvement in Rakes for Harvesters;* Isaac Van Doren, Somerville, New Jersey.

Claim.—"Operating the rake when arranged in relation to the platform, by means of the double geared sector, in combination with the rod and rock shaft, or their equivalent."

182. For an *Improvement in Carding Engines;* Wm. H. Walton, Brooklyn, N. Y., and George H. Phinney, City of New York.

"This invention consists in the use of a cylinder brush arranged with a lever in such a manner as to oscillate to and from the main cylinder for the purpose of cleaning the same."

Claim.—"The application and use of a rotary brush for stripping the main cylinder, in combination with the lever, or its equivalent, by which the main cylinder is stripped and cleaned when running at the speed given, by shifting the driving belt from the driving pulley to the loose pulley."

183. For an *Improved Nut Machine;* Samuel H. Whitaker, Cincinnati, Ohio.

"This invention consists in a provision for making metallic nuts of definite thickness and materially varying from that of the bar, and so as to save the scrap produced by punching."

Claim.—"The use of the preparatory punch and die, with the shearing and finishing die, punch, or mandrel, and counter die, whereby a nut of definite thickness is formed by first partially punching the blank while joined to the bar, and confined on every other side, then separating the blank and completing the punching and shaping."

184. For an *Improvement in Valve Gear for Oscillating Steam Engines;* Norman W. Wheeler, City of New York.

Claim.—"Actuating the valves of oscillating steam engines by the combined movements of the cylinder and piston rod."

185. For an *Improvement in Diving Apparatus;* George Williamson, Brooklyn, New York.

Claim.—"The employment, in combination with the nautilus of the channel ways, for the escape at the sides of the compressed air from the working chamber, the said channel ways being made in the thickness at the bottom of the nautilus, that is, between the floor of the working chamber and the outer bottom surface of the nautilus. Also, combining the nautilus with, and suspending it to, a float or buoy, so that the apparatus for operating the connecting rope, or equivalent, may be worked from the inside of the nautilus. Also, combining a spring balance or scale, with the combined nautilus and float."

186. For an *Improved Fly-trap;* Samuel R. Wilmot, Watertown, Connecticut.

Claim.—"A fly-trap consisting of a receptacle which is constructed and operated in such manner that when it is swept over a table or other object, the mouth is open to receive flies, and when the sweeping movement is finished, the mouth is closed to prevent their escape."

187. For an *Improved Fire Escape Ladder;* Henry Loewenberg, City of New York.

Claim.—"The manner of regulating or adjusting the trucks by means of the hinged guide pole or guide bars, arranged and operating in the manner and for the purpose of supporting the ladders when secured by the rope at any desired angle."

188. For an *Improved Cooler;* W. E. Messenger and Henry Rehahn, City of New York.

"Our invention consists of a hollow vessel for receiving the ice made in the form of

a saddle, so that it may be readily set or placed on the top of barrels or casks, containing the liquid to be refrigerated."

Claim.—"The refrigerating saddle."

189. For an *Improved Machine for Distributing Type;* W. H. Mitchel, Brooklyn, N.Y.

Claim.—"1st, The inclined check block, in combination with notches in the sides of the types, so placed that the notch of the first type comes in contact with the said inclined check block, when the type is projected its thickness beyond the end of the slide containing the line of types, so that only one type at a time is separated from the line of types. 2d, The use of studs or pins uniformly placed to take notches variously placed in the types, thereby sustaining the types in various positions, to be dropped or distributed when said types reach receptacles adapted to the peculiar position of said types. 3d, The method of distributing types by the revolving wheel, with its grooves and pins, when combined with the stationary inclines or off-sets. 4th, Distributing types from uniformly placed and moving pins, or their equivalents, by the use of a second notch in the type, combined with suitable off-sets or inclines to disengage the first notch of the type, and then allow the type to be suspended by the second notch for distribution, thereby providing for distributing greater varieties of type without requiring extreme accuracy in the position of the notches. 5th, The oscillating ring and connecting rods, in combination with the pushers."

190. For an *Improvement in Pencil Sharpeners;* Joseph W. Strange and Samuel Darling, Bangor, Maine.

Claim.—"The combination of two cutters constructed and arranged to reduce the wood and the lead separately."

191. For an *Improved Wrench;* Henry D. Blake, New Hartford, Assignor to W. H. Warner, New Britain, Connecticut.

Claim.—"The combination with a vibrating stock or handle, arranged for action, of the two or inner and outer sliding jaws of the wrench, jointed on opposite sides to said stock or handle, and both jaws operated or expanded and contracted in reverse directions to effect and release the gripe by the lateral throw or motion proper of said handle, in both directions of its swing. Also, while not claiming a projecting thumb-piece to a single sliding jaw, to lock or release the gripe of the same by means of a cam, or its equivalent, connected therewith. I do not claim providing the one jaw with a projecting thumb-piece, arranged to overlap the jointed attachment of said jaw to the stock, and forming a rigid extension as it were of said jaw to facilitate the action or movement of both jaws."

192. For an *Improvement in Harvesters;* Samuel Pennock, Assignor to self and Morton Pennock, Kennett's Square, Pennsylvania.

Claim.—"Adjusting and regulating the position of the crank shaft, by means of mechanism."

193. For an *Improvement in Lathes for Manufacture of Clothes Pins, etc.;* John Humphrey, Keene, Assignor to self and Amos E. Perry, Harrisville, N. H.

Claim.—"The method of feeding the pieces to be turned to the spindles, when their relative positions are changed, and in combination with the above, removing the finished pieces from the spindles."

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194. For an *Improved Method of Holding and Setting the Log in Circular Sawing Machines;* James H. Bachelder, Rome, Michigan.

"This invention relates to an improvement in that class of sawing machines which are designed for sawing both fence pickets, and similar stuff, or articles direct from the log."

Claim.—"1st, Setting the log to the saws or giving it its lateral movement at the termination of each stroke or movement of the carriage, by means of the screws on which the nuts on the uprights work, the screw being turned at the proper time by means of the belt, which is made to act upon the wheel by means of the loop attached to lever, the lever being actuated by the forked lever coming in contact with the projections on the plates attached to beam, the length of movement of the log being determined or regulated by the rack, rod, pawl, or any equivalent device. 2d, Securing the log in the carriage or to the cross-piece supported therein by the uprights, by means of the rods attached to the cross-piece, by means of the plates and rods having eccentrics on

them. The eccentrics being in one end of the plates, and the rods passing through the opposite ends."

195. For an *Improvement in Compositions for Covering Meats;* John J. Bate, Brooklyn, New York, and Francis S. Low, Jersey City, New Jersey.

Claim.—"The use of shellac, varnish, and beeswax, in combination with the materials, and in about the proportions named, for the purpose of forming the composition."

196. For an *Improvement in Lard Rendering Kettles;* J. J. Bate, Brooklyn, N. Y.

Claim.—"The combination of the valve, acting both as a shifting and a vacuum valve, with the shell and kettle."

197. For an *Improvement in Steam Pressure Gauges;* H. Bates, New London, Conn.

Claim.—"The arrangement of the sector with teeth on its side face, and radial bearing projection near its axis, on an axis which is at right angles to the shaft of the pointer pinion, and to a controlling stud which terminates in an eccentric curve."

198. For an *Improved Apparatus for Opening Oysters;* W. Beach, Baltimore, Md.

Claim.—"The combination of lippèd bar, treadle, and spring, with the cutting head piece."

199. For an *Improvement in Life Preservers;* Charles J. Bunker, City of N. York.

Claim.—"A life preserver, constructed of two or more sheets of water-proof fabric, with the series of air cells arranged so as to cover the upper and vital parts of the body."

200. For an *Improvement in the Cribs of Horses' Stables;* Wm. Croasdale, Harstville, Pennsylvania.

Claim.—"The revolving roller, in connexion with the striker."

201. For an *Improvement in Steam Boilers;* W. M. and J. B. Ellis, Washington, D. C.

Claim.—"Connecting the upper and lower parts of the shell of the body of the boiler, by means of a strong perforated plate, which performs the double office of staying the boiler and forming a passage for the circulation of the water and steam through the legs and body of the boiler."

202. For an *Improvement in Fastenings for Jewelry;* J. T. Folwell, Philadelphia, Pa.

Claim.—"The round post with a notch filed in it to receive the pin or tongue in, and a sheath fitting tight round the post, and shifted by a lever, so that when in one position, the tongue can be put into the notch, and when put into the opposite position it secures the tongue in its place, so that it cannot come out without shifting the lever."

203. For an *Improvement in Preparing Roofing Cements;* R. T. Havens, Casstown, O.

Claim.—"The process of combining and pressing coal tar and sand with paper or wood, for the production of an artificial slate."

204. For an *Improvement in Factitious Oils;* Joseph W. Harmon, Elizabethtown, N. J.

Claim.—"The employment of the residuum of candle manufactories, compounded with the ingredients in the manufacture of a compound oil."

205. For an *Improved Hydraulic Engine;* John D. Heaton, Dixon, Illinois.

Claim.—"The peculiarly constructed form and application, and the arrangement of the stationary valves, and as operated. Also, the construction and arrangement of the water chambers, pressure compartments, and cylinder, combined in one single piece."

206. For an *Improvement in Coating Hose Pipe;* C. H. Hinckley, Stonington, Conn.

Claim.—"The process of constructing pipe of textile and fibrous materials, with an internal coating of vulcanized india rubber, viz: by first applying the india rubber coating on the outside, and afterwards inverting the same by drawing it over and through a metallic cylinder."

207. For an *Improved Bit-Holder;* Benjamin B. Hill, Chicopee, Massachusetts.

Claim.—"The diagonal bit-holder, having a projection or rest which forms a guard to the level gears, and gives support to the bit."

208. For an *Improved Approach Opening Gate;* Charles A. Howard, Pontiac, Mich.

Claim.—"Applying the power of a weight or spring to the gate through the medium of the crank shaft connecting rods, in combination with the latch or catch, arranged with the levers and bars so as to operate conjointly."

209. For an *Improvement in Reed Stops for Musical Instruments;* Amos P. Hughes, Philadelphia, Pennsylvania.

Claim.—"The stopping of reeds by forming an air tight chamber or chambers outside of the reeds with the swell, or by other means, in combination with the open communication between the inside of the chamber or chambers, and the interior of the wind-chest or bellows, or any other arrangement substantially the same."

210. For an *Improvement in Sewing Machines;* Edward A. Jenks and John Underwood, Lowell, Massachusetts.

Claim.—"The arrangement of the spring feed piece with its pressure guide or sheath. Also, the rollers and looper as arranged and operating, in combination with the needle."

211. For an *Improvement in Cork Sole Stuff;* Wm. Johnson, Brooklyn, New York.

"This invention consists in rendering silk, cotton, leather, or other material, waterproof, with all the requisite qualities of solid sheet cork."

Claim.—"The making of cork cloth for inside soles and lining of boots, shoes, and other articles, for which solid sheet cork has hitherto been applied, using for that purpose materials to produce the same results."

212. For an *Improved Machine for Cutting Bungs;* Josiah Kirby, Cincinnati, Ohio.

Claim.—"The oscillating bit-holders, when operated by means of opposite bevels on the centre-rod, acting against the adjusting rods and the tail-screws. Also, the mode of grasping the block and freeing the finished bung."

213 For an *Improvement in Setting Diamonds, &c.;* Isaac Lindsley, Providence, R. I.

Claim.—"The raising of points or studs on the veins of the blank by the same punching operation which forms the blank, thereby producing a superior setting, which gives a greater brilliancy to the stones at a cost of labor not greater than that of the setting commonly used in cheap jewelry."

214. For an *Improvement in Gas Burners;* Wm. H. Lindsay, Brooklyn, New York.

"This invention consists in the use of certain deflectors with a fish-tail or other burner of suitable construction, for producing a more perfect combustion of the gas, with an increased intensity of light."

Claim.—"The application to a gas burner or burners of angular pieces or deflectors, or the equivalent thereof, for the purpose of increasing the light derived from one or more streams of gas issuing or escaping from a gas burner or burners of any suitable construction, by altering and directing the current or currents of gas, and the form of flame."

215. For an *Improvement in Hame-tug Fastening;* W. J. Lockwood, Sturgis, Mich.

Claim.—"The stud or button holder, and the button or lock, in combination with the socket, when operating together."

216. For an *Improvement in the Manufacture of the "Uppers" of Boots and Shoes without Seams;* Samuel Middleton, England; patented in England Nov. 3, 1856.

Claim.—"Stretching and forming the upper leather for boots and shoes from a single piece of leather without seams."

217. For an *Improvement in Burglars' Alarms;* E. M. and J. E. Mix, Ithaca, N. Y.

Claim.—"The construction of the device, to wit, the hammer or cock, spring, trigger, and rod, constructed, arranged, and applied to the barrel and stock."

218. For an *Improved Apparatus for Separating Oily Matter from Water;* James Naughten, Cincinnati, Ohio.

Claim.—"The arrangement of the chambers when the chambers are connected with the opening."

219. For an *Improvement in Spikes;* Orrin Newton, Pittsburgh, Pennsylvania.

Claim.—"Constructing the spike with concave sides and edges."

220. For an *Improvement in Corn Shellers;* J. J. Parker, Marietta, Ohio.

Claim.—"The necked shelling-wheel, when arranged and operating in connexion with the shelling-wheel and elastic side of spout and spring."

221. For an *Improved Apparatus for Roasting on Cooking Stoves, Ranges, &c.;* Samuel Pierce, Troy, New York.

Claim.—"The construction and arrangement of the apparatus for the purpose of combining with a range or stove for the purpose of roasting."

222. For an *Improvement in Machines for Manufacturing Pottery Ware;* Philip Pointon, Baraboo, Wisconsin.

Claim.—"Operating the movable bottom and plunger simultaneously, by means of the sliding rods and cross-head, in combination with lever and rack."

223. For an *Improvement in Awning Frames for Horses Attachable to Harness;* N. Pullman, New Oregon, Iowa.

Claim.—"1st, Arranging the frame for the support of an awning over draft horses, with a flexible joint, so that it can be folded back from the head and neck of the horse, and removed with the harness. 2d, Connecting the front bow with the bridle, by means of flexible bands."

224. For an *Improvement in Fastening for Metallic Bands of Cotton Bales, &c.;* Charles J. Provost, Sardis, Alabama.

Claim.—"So forming the slide as that its ends may be struck down behind the bow or bend of the locks, and thus not only prevent the lock from separating, but also hold in the slide to the lock."

225. For an *Improved Apparatus to Protect Buildings from Fire;* Thomas Odion, Portsmouth, New Hampshire.

Claim.—"The method of protecting property against fire by means of a portable screen."

226. For an *Improved Method of Attaching Adjustable Handles to Joiners' Planes;* Thomas D. Worrall, Lowell, Massachusetts.

"This invention consists in certain devices for attaching and adjusting the handles on moulding planes."

Claim.—"1st, The combination and arrangement of cap-plate, screw, nut, and slot, in the plane, for the purpose of providing and securing a movable handle to planes. 2d, The arrangement of cap-plate, slotted strap, and screw, for the purpose of adjusting the handle vertically when desired by the operator."

227. For an *Improvement in the Construction of Wire Fences;* J. B. Reyman, Bloomington, Illinois.

Claim.—"Bending or kinking the wires."

228. For an *Improved Method of Stemming and Polishing Pea Nuts;* Samuel Shepherd, Nashua, New Hampshire.

Claim—"Stemming and polishing pea nuts by means of machinery."

229. For an *Improvement in Hemp Brakes;* Conrad Simon, Louisville, Kentucky.

Claim.—"The combination of the breaking rollers with the mouth-piece."

230. For an *Improvement in Window for Locomotives, &c.;* H. Skinner, Fulton, N. Y.

Claim.—"The application of heat to glass to prevent vapor or frost from collecting thereon."

231. For an *Improved Drilling and Milling Machine;* Wm. D. Sloan, City of N. Y.

Claim.—"The mode of operation for securing and holding the blocks to the periphery of the wheel, by which they are shifted from place to place, which mode of operation results from the combination of the radially sliding stirrups, or their equivalents, with the wheel, and the mechanism operating the said stirrups to liberate and gripe the blocks, or any equivalent therefor. Also, connecting the stirrups, or any equivalent therefor, with the radially sliding rods, by a yielding joint, in combination with the oblique edges of the recesses in which they slide, or any equivalent therefor, so that the said stirrups when forced out shall be brought in a radial position, and be free to yield laterally to any irregularity of form of the blocks to be griped when drawn in. Also, in combination with the carrying wheel, or equivalents therefor, for holding and shifting the blocks, the two sets of hollow mandrels with appropriate cutters, and having a reciprocating motion in opposite directions for acting on the opposite ends of the blocks."

232. For an *Improved Mode of Attaching Elastic Soles to Horse Shoes;* Wm. Somerville, Buffalo, New York.

Claim.—"The sole provided with prongs or metallic projections, or their equivalents in combination with recesses or rebates, or their equivalents, in or above the shoe."

233. For an *Improved Hydro-carbon Vapor Lamp;* Isaac Suggitt, Providence, R. I.

Claim.—"A tube, in combination with arms or projections, and corrugated hoop, to be used in any container or lamp."

234. For an *Improved Method of Opening and Closing Vertico-lateral Folding Gates;* Francis Thrasher and Henry B. Horton, Akron, Ohio.

Claim.—"1st, Balancing the gate upon a single fulcrum pin, whilst the gate is held to the post and guided by another pin working in a slot, thus giving a steady motion to the gate in folding and unfolding. 2d, The eccentric quadrant plate, by means of which the action of weight, and also the action of the hand (when pulling upon either of the cords), are varied so as to easily set the gate in motion, and yet prevent the gate from opening or closing with violence. 3d, The combination of the crooked lever with the springs and cords, whereby a slight pull upon either of the cords will unlock the gate and let it fly open, whilst a stronger pull upon the same cord will close the gate."

235. For an *Improvement in Pumps;* J. D. West, City of New York.

Claim.—"The combination of the air chamber with two inner cylinders, and duplicate foot valves."

236. For an *Inprovement in Hollow Metallic Lasts;* S. H. Whorf, Malden, Mass.

Claim.—"Making a last with the yielding or spring instep."

237. For an *Improvement in Variable Eccentrics for Operating the Valves of Steam Engines;* S. L. Wiegand, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the double oblique slide upon the shaft, said slide passing through the eccentric."

238. For an *Improvement in Machines for Measuring Cloth;* Wm. W. Wythes, St. Clair, Pennsylvania.

Claim.—"1st, The arrangement of the measuring roller with the pressure roller, when the latter is hung loosely on a hinged spindle, and acted upon by a spring, and when it is exposed at the end for the admission of the fabric. 2d, The combination of the shape-wheel, lever, shaft, wheels, and numbered plate, index, and pointer."

239. For an *Improved Marine Propelling Apparatus;* Ethan Campbell, Boston, Assignor to Wm. C. Page, Cambridge, and Edward F. Hodges, Boston, Mass.

Claim.—"My improved propelling apparatus, constructed and operating so that its wing cylinder and wing plate may not only simultaneously rise and fall in their case, but at the same time have lateral motions in contrary directions, and the wing operate against a space so formed in, and applied to, the case, as not only to be in contact, or nearly so, with the opposite sides of the wing, but allow the vibratory as well as the up and down movements of the wing."

240. For an *Improved Tank for Locomotives;* John Kimball, Concord, New Hampshire, Assignor to Robert Hale, Roxbury, Massachusetts.

Claim.—"Dividing the water tank into two compartments, thus introducing a trap between the two, for the purpose of intercepting the passage of the oil to the boiler."

Re-Issues.

1. For an *Improvement in Looms;* Daniel W. Snell and Stephen S. Bartlett, Woonsocket, Rhode Island; patented January 13, 1857; re-issued September 1, 1857.

Claim.—"1st, Employing the positive take-up mechanism or cloth roll, or any mechanism acted on, or affected by, the strain of the cloth, when a positive take-up is used as the point through which the variable strain and wind of warps is made to act more sensitively, than from or by the variable vibratory reacting motion of the whip rolls, or sudden jerking of the beam or movable reed. 2d, Effecting and producing a regular delivery and uniform strain of the warps by the equalizing strain lever, or equivalent, said lever being acted upon by the variable strain of the warps or cloth through the positive take-up mechanism or cloth roll. 3d, The equalizing strain lever or analogous device, when operating in connexion with the positive take-up mechanism or cloth roll, or when effected by the strain of the cloth, in combination with any mechanism for producing a rotary motion to the beam, and with any device or means for regulating the delivery and strain of the warps as the beam decreases in diameter, and as the desired

strain requires. 4th, Employing the rod with the pin, or equivalent, to act upon the strain lever, as a means of moving the weight when the balance spring, or equivalent device, is not sufficient to move it. 5th, In combination with the pulley and pinion, the movable weight, the fixed or yielding sectional friction piece, and friction lever. 6th, In combination with the weight and friction lever, the rack, or its equivalent, to so act upon weight, through catches, or analogous devices, as to gradually move this weight towards the fulcrum of lever, as the bearer decreases in diameter, and as the desired strain of warp requires. 7th, In combination with the weight and friction lever, or equivalent devices, the jointed or stationary sectional friction piece, and set screw."

2. For an *Improvement in Carding Engines;* Wm. H. Walton, City of New York; patented December 9, 1856; re-issued January 13, 1857.

Claim.—"Suspending the top flats or workers upon pivots in the centre of their ends, by which they can be raised out of the way of the adjoining flats, and turned by a rack working into pinions, or the equivalent thereof. Also, stripping the flats or workers by a rotating brush, so arranged that a card may strip the brush and return the strippings to the main cylinder. Also, the combination and employment of two or more 'lickers-in,' acting as 'lickers-in' and 'workers,' by running in contact with each other, or their equivalent, for the purpose of working the fibre before it enters on to the main cylinder."

3 For an *Improvement in Compositions for Roofing;* James West, Syracuse, N. Y.; re-issued September 8, 1857.

Claim.—"The use of lime, in combination with the rubber or gutta-percha and shellac solutions, in the composition."

4. For an *Improvement in Elastic Gore Cloth;* Charles Winslow, Lynn, Mass.; patented August 4, 1857; re-issued September 15, 1857.

Claim.—"An elastic band or gore cloth, when made not only of a fabric composed of a cement of india rubber or gutta-percha, and two pieces of cloth, in which the warp and weft of each piece are made to cross one another diagonally or at acute angles, but with the edges of the cloth cut and overlapped, and cemented down in a line or lines out of parallelism with either the warp or weft threads, the line of maximum elasticity in the binding, making that angle with the warps as well as the weft which is the complement of half the angle which they make with each other."

5. For an *Improved Abdominal Supporter;* Julia M. Milligan, New Albany, Indiana; patented February 10, 1857; re-issued September 15, 1857.

Claim.—"The bandage provided with a series of cords and laces, or their equivalents."

6. For an *Improvement in Looms;* Wm. V. Gee, New Haven, Connecticut, Assignor to The Atwater and Bristol Manufacturing Co., Assignors to The Nashawannock Manufacturing Co, East Hampton, Mass.; patented February 27, 1855; re-issued September 15, 1857.

Claim.—"1st, Mounting a loom with two distinct sets of harness, each governing all the warp threads for the weaving of a web on one side of an intended button hole or slit, and capable of being thrown out of action each by itself, while the other set is in action, during the process of weaving button holes. 2d, Connecting each set of harness capable of being thrown in and out of action, and governing all the warp threads on either side, with a bar or slide governed by a cam or catch, or the equivalents thereof, to throw one or the other of the said sets of harness out of action when necessary. 3d, The combination of the mechanism for causing one set of harness to cease its action, or any equivalent therefor, with another mechanism for determining the period during which one set of harness shall remain out of action, or lay dormant, or the time or moment at which such harness shall cease to act, or any equivalent therefor. 4th, The combination of a slow moving cam or cams, or its or their equivalents, for determining the time and period, or time or period, during which a set of harness shall be out of action, with harness mounted in sets, each set governing all the warp threads on one side of a button hole, so that different sets of harness may be in action, or laying dormant, at proper times and for proper periods. 5th, A contrivance for throwing the take-up motion out of gear, or any equivalent therefor, for stopping the take-up, in combination with two sets of harness, each governing warp threads. And, lastly, the combination of a slow moving cam, or any equivalent thereof, with a mechanism for stopping or starting a take-up motion, or any equivalent therefor, whereby the time and period, or time or period, of the stoppage or cessation from action of a take-up motion, may be determined automatically."

7. For an *Improvement in Apparatus for Stenciling Window Shades;* Daniel Lloyd, Assignor to G. L. Kelty and D. M. Ferguson, City of New York; patented Jan. 29, 1856; re-issued September 15, 1857.

Claim.—"1st, Producing patterns on window shades in which long or continuous lines form a prominent feature, by means of a pair or pairs of stencils, of the full size of the design. 2d, The mode of registering the stencils by the use of the plates and pins, for the purpose of adjusting and readily adapting the stencils to shades."

8. For an *Improvement in Coating Water Pipes;* Jonathan Ball, Elmira, New York; patented December 15, 1843: re-issued September 15, 1857.

Claim.—"Lining metallic pipes with hydraulic cement, by means of a cone, or its equivalent, guided through the pipe so as to lay on the cement of equal thickness, and with great certainty and economy."

9. For an *Improvement in Cast Iron Car Wheels;* Anson Atwood, Troy, New York; patented May 15, 1847; re-issued September 22, 1857.

Claim.—"Connecting the rim of a wheel cast in one piece, with a solid hub, by means of a single waved plate, in combination with the dished flanches of the hub, forming a ring concentric with the rim of the wheel, whereby the several parts can yield to the unequal contraction in all directions, without serious strain of the metal."

10. For an *Improvement in Cast Iron Car Wheels;* Anson Atwood, Troy, New York; patented May 15, 1847; re-issued September 22, 1857.

Claim.—"A cast iron disk corrugated, when used in connexion with the chilled rim of a cast iron wheel."

11. For an *Improvement in Seed Planters;* Solomon T. Holly, Rockford, Illinois; re-issued September 22, 1857.

Claim.—"In combinalion with a machine that drops its seed automatically, a hand lever and clutching apparatus, that enables the operator to quicken or retard the dropping so as to bring it to the exact spot, and without disarranging or injuriously affecting the automatic movement. Also, in combination with the wheel having its centre of motion, and furnished with openings, the lever with its plate, and hung or pivoted at a point eccentric to the point, so that the plate can cover or be drawn within the range of the openings at stated intervals. Also, the employment or the use of the indicator, connected with the valve."

12. For an *Improved Process for Removing Photographs from Glass to Paper;* Edward Howell, Ashtabula, Ohio; patented May 19, 1857; re-issued Sept. 22, 1857.

Claim.—"The use of beeswax, or its equivalent, laid upon the surface of the glass plate previous to applying the collodion film, chemicals, and colors, for the purpose of facilitating the removal of the picture, together with the manner of causing the backing paper to adhere to the finished picture, thus giving it strength to overcome the adhesion of the wax, or its equivalent, to the plate of glass."

13. For an *Improvement in Ladies' Skirts;* Edward F. Woodward, City of New York, patented June 16, 1857; re-issued September 29, 1857.

Claim.—"Constructing hoops intended for ladies dresses, consisting of a spiral formed of any proper material, metallic or vegetable, either with or without a core to support the same, which can be bent into the form of a hoop, and inserted into ladies' skirts."

DESIGNS.

1. For *Stoves;* N. S. Vedder, Troy, New York, Assignor to North, Chase & North, Philadelphia, Pennsylvania; dated September 1, 1857.
2. For *Stoves;* Thomas Barry, City of New York; September 1, 1857.
3. For *Type;* George Bruce, City of New York; dated September 8, 1857.
4. For *Sad Iron Stove;* S. W. Gibbs, Assignor to Winne & Abeil, Albany, New York; dated September 8, 1857.
5. For *Stoves;* Garretson Smith, Henry Brown, and Samuel H. Sailor, Assignors to I. G. Abbott & A. Lawrence, Philadelphia, Pennsylvania; dated September 15, 1857.
6. For *Gas Burner Shades;* George B. Foster, Boston, Massachusetts; dated September 22, 1857.

7. For *Stands to Hold Shovels and Tongs;* Julius Meyer, Assignor to M. Greenwood & Co., Cincinnati, Ohio; dated September 29, 1857.

8. For *Stands to Hold Shovels and Tongs;* Julius Meyer, Assignor to M. Greenwood & Co., Cincinnati, Ohio; dated September 29, 1857.

The claims on the foregoing are for the several shapes, forms, and ornaments.

MECHANICS, PHYSICS, AND CHEMISTRY.

*On the Sounds Produced by the Combustion of Gases in Tubes.**

By John Tyndall, Esq., F.R.S.

In the first volume of "*Nicholson's Journal*," published in 1802, the sounds produced by the combustion of hydrogen in tubes are referred to as having been "made in Italy:" Dr. Higgins, in the same place, shows that he had discovered them in the year 1777, while observing the water formed in a glass vessel by the slow combustion of a slender stream of hydrogen. Chladni, in his "*Akustik*," published in 1802, page 74, speaks of their being mentioned, and incorrectly explained, by De Luc in his "*New Ideas on Meteorology*:" I do not know the date of the volume. Chladni himself showed that the tones produced were the same as those of an open pipe of the same length as the tube which encompassed the flame. He also succeeded in obtaining a tone and its octave from the same tube, and in one case obtained the fifth of the octave. In a paper published in the *Journal de Physique* in 1802, G. De la Rive endeavored to account for the sounds by referring them to the alternate contraction and expansion of aqueous vapor; basing his opinion upon a series of experiments of great beauty and ingenuity made with the bulbs of thermometers. In 1818, Mr. Faraday took up the subject, and showed that the tones were produced when the glass tube was enveloped by an atmosphere higher in temperature than 212° Fahr. That they were not due to aqueous vapor, was further shown by the fact that they could be produced by the combustion of carbonic oxide. He referred the sounds to successive explosions produced by the periodic combination of the atmospheric oxygen with the issuing jet of hydrogen gas. This is undoubtedly the true source of the sounds.

I am not aware that the dependence of the pitch of the note on the size of the flame has as yet been noticed. To this point I will, in the first place, briefly direct attention.

A tube 25 inches long was placed over an ignited jet of hydrogen: the sound produced was the fundamental note of the tube.

A tube 12½ inches long was brought over the same flame, but no sound was obtained.

The flame was lowered, so as to make it as small as possible, and the tube last mentioned was again brought over it; it gave a clear melodious note, which was the octave of that obtained with the 25-inch tube.

The 25-inch tube was now brought over the same flame; it no longer

* From the Journal of Gas Lighting, &c., No. 126.

gave its fundamental note, but exactly the same note as that obtained from the tube of half its length.

Thus we see, that although the speed with which the explosions succeed each other depends upon the length of the tube, the flame has also a voice in the matter: that to produce a musical sound, its size must be such as to enable it to explode in unison either with the fundamental pulses of the tube, or with the pulses of its harmonic divisions.

With a tube 6 feet 9 inches long, by varying the size of the flame, and adjusting the depth to which it reached within the tube, I have obtained a series of notes in the ratio of the numbers 1, 2, 3, 4, 5.

These experiments explain the capricious nature of the sounds sometimes obtained by lecturers upon this subject. It is, however, always possible to render the sounds clear and sweet, by suitably adjusting the size of the flame to the length of the tube.*

Since the experiments of Mr. Faraday, nothing, that I am aware of, has been added to this subject, until quite recently. In a recent number of Poggendorff's "*Annalen*," an interesting experiment is described by M. Schaffgotsch, and made the subject of some remarks by Prof. Poggendorff himself. A musical note was obtained with a jet of ordinary coal gas, and it was found that when the voice was pitched to the same note, the flame assumed a lively motion, which could be augmented until the flame was actually extinguished. M. Schaffgotsch does not describe the conditions necessary to the success of his experiment; and it was while endeavoring to find out these conditions that I alighted upon the facts which form the principal subject of this brief notice. I may remark that M. Schaffgotsch's result may be produced, with certainty, if the gas be caused to issue under sufficient pressure through a very small orifice.

In the first experiments I made use of a tapering brass jet, 10½ inches long, and having a superior orifice about $\frac{1}{20}$th of an inch in diameter. The shaking of the singing flame, within the glass tube, when the voice was properly pitched, was so manifest as to be seen by several hundred people at once.

I placed a syrene within a few feet of the singing flame, and gradually heightened the note produced by the instrument. As the sounds of the flame and syrene approached perfect unison, the flame shook, jumping up and down within the tube. The interval between the jumps became greater, until the unison was perfect, when the motion ceased for an instant; the syrene still increasing in pitch, the motion of the flame again appeared, the jumpings became quicker and quicker, until finally it escaped cognizance by the eye.

This experiment showed that the jumping of the flame, observed by M. Schaffgotsch, is the optical expression of the *beats* which occur at each side of the perfect unison; the beats could be heard in exact accordance with the shortening and lengthening of the flame. Beyond

* With a tube 14½ inches in length and an exceedingly minute jet of gas, I obtained, without altering the quantity of gas, a note and its octave: the flame possessed the power of changing its own dimensions to suit both notes.

the region of these beats, in both directions, the sound of the syrene produced no visible motion of the flame. What is true of the syrene is true of the voice.

While repeating and varying these experiments, I once had a silent flame within a tube, and on pitching my voice to the note of the tube, the flame, to my great surprise, instantly started into song. Placing the finger on the end of the tube, and silencing the melody, on repeating the experiment, the same result was obtained.

I placed the syrene near the flame, as before. The latter was burning tranquilly within its tube. Ascending gradually from the lowest notes of the instrument, at the moment when the sound of the syrene reached the pitch of the tube which surrounded the gas flame, the latter suddenly stretched itself and commenced its song, which continued indefinitely after the syrene had ceased to sound.

With the jet which I have described, and a glass tube, 12 inches long, and from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch internal diameter, this result can be obtained with ease and certainty. If the voice be thrown a little higher or lower than the note due to the tube, no visible effect is produced upon the flame: the pitch of the voice must lie within the region of the audible beats.

By varying the length of the tube we vary the note produced, and the voice must be modified accordingly.

That the shaking of the flame, to which I have already referred, proceeds in exact accordance with the beats, is beautifully shown by a tuning-fork which gives the same note as the flame. Loading the fork so as to throw it slightly out of unison with the flame, when the former is sounded and brought near the flame, the jumpings are seen at exactly the same intervals as those in which the beats are heard. When the tuning-fork is brought over a resonant jar or bottle, the beats may be heard and the jumpings seen by a thousand people at once. By changing the load upon the tuning-fork, or by slightly altering the size of the flame, the quickness with which the beats succeed each other may be changed, but in all cases the jumpings address the eye at the same moment that the beats address the ear.

With the tuning-fork I have obtained the same results as with the voice and syrene. Holding a fork over a tube which responds to it, and which contains within it a silent flame of gas, the latter immediately starts into song. I have obtained this result with a series of tubes varying from $10\frac{1}{2}$ to 29 inches in length. The following experiment could be made. A series of tubes, capable of producing the notes of the gamut, might be placed over suitable jets of gas; all being silent, let the gamut be run over by a musician with an instrument sufficiently powerful, placed at a distance of twenty or thirty yards. At the sound of each particular note, the gas-jet contained in the corresponding tube would instantly start into song.

I must remark, however, that with the jet which I have used, the experiment is most easily made with a tube about 11 or 12 inches long; with longer tubes it is more difficult to prevent the flame from singing spontaneously, that is, without external excitation.

The principal point to be attended to is this. With a tube, say of 12 inches in length, the flame requires to occupy a certain position in the tube in order that it shall sing with a maximum intensity. Let the tube be raised, so that the flame may penetrate it to a less extent; the energy of the sound will be thereby diminished, and a point (A), will at length be attained where it will cease altogether. Above this point, for a certain distance, the flame may be caused to burn tranquilly and silently for any length of time, but when excited by the voice it will sing.

When the flame is too near the point (A), on being excited by the voice or by a tuning-fork, it will respond for a short time and then cease. A little above the point where this cessation occurs, the flame burns tranquilly, if unexcited, but if once caused to sing it will continue to sing. With such a flame, which is not too sensitive to external impressions, I have been able *to reverse the effect hitherto described*, and to stop the song at pleasure by the sound of my voice, or by a tuning-fork, without quenching the flame itself. Such a flame I find may be made to obey the word of command, and to sing or cease to sing as the experimenter pleases.

The mere clapping of the hands, producing an explosion, shouting at an incorrect pitch, shaking of the tube surrounding the flame, are, when the arrangements are properly made, ineffectual. Each of these modes of disturbance doubtless affects the flame, but the impulses do not accumulate, as in the case where the note of the tube itself is struck. It appears as if the flame were *deaf* to a single impulse, as the tympanum would probably be, and, like the latter, needs the accumulation of impulses to give it sufficient motion. A difference of half a tone between two tuning-forks is sufficient to cause one of these to set the flame singing, while the other is powerless to produce this effect.

I have said that the voice must be pitched to the note of the tube which surrounds the flame; it would be more correct to say the note produced by the flame when singing. In all cases, this note is sensibly higher than that due to the open tube which surrounds the flame: this ought to be the case, because of the high temperature of the vibrating column. An open tube, for example, which, when a tuning-fork is held over its end, gives a maximum reinforcement, produces, when surrounding a single flame, a note higher than that of the fork. To obtain the latter note, the tube must be sensibly longer.

What is the constitution of the flame of gas while it produces musical sounds? This is the next question to which I will briefly call attention. Looked at with the naked eye, the sounding flame appears constant; but is the constancy real? Supposing each pulse to be accompanied by a physical change of the flame, such a change would not be perceptible to the naked eye, on account of the velocity with which the pulses succeed each other. The light of the flame would appear continuous on the same principle that the troubled portion of a descending liquid jet appears continuous, although by proper means this portion of a jet can be shown to be composed of isolated drops. If we cause the image of the flame to pass speedily over different portions of the retina, the

changes accompanying the periodic impulses will manifest themselves in the character of the image thus traced.

I took a glass tube 3 feet 2 inches long, and about an inch and a half in internal diameter, and, placing it over a very small flame of olefiant gas (common gas will also answer), obtained the fundamental note of the tube. On moving the head to and fro, the image of the sounding flame was separated into a series of distinct images: the distance between the images depended upon the velocity with which the head was moved. This experiment is suited to a darkened lecture-room. It was still easier to obtain the separation of the images in this way, when a tube 6 feet 9 inches in length and a larger flame were made use of.

As suggested to me by a lady to whom I had the pleasure of showing these experiments, the same result is obtained when an opera-glass is moved to and fro before the eye.

But the most convenient mode of observing the flame is with a mirror; and it can be seen either directly in the mirror, or by projection upon a screen.

A lens of 33 centimeters focus was placed in front of a flame of common gas, upwards of an inch long, and a paper screen was hung at about 6 or 8 feet distance behind the flame. In front of the lens a small looking-glass was held, which received the light that had passed through the lens, and reflected it back upon the screen placed behind the latter. By adjusting the position of the lens, a well-defined inverted image of the flame was obtained upon the screen. On moving the mirror the image was displaced; and, owing to the retention of the impression by the retina, when the movement was sufficiently speedy, the image described a continuous luminous track. Holding the mirror still, the 6 foot 9-inch tube was placed over the flame: the latter changed its shape the moment it commenced to sound, remaining, however, well defined upon the screen. On now moving the mirror, a totally different effect was produced: instead of a continuous track of light, a series of distinct images of the sounding flame was observed. The distance of these images apart varied with the motion of the mirror; and, of course, could be made, by suitably turning the reflector, to form a ring of images. The experiment is beautiful, and in a dark room may be made visible to a large audience.

The experiment was also varied in the following manner:—A triangular prism of wood had its sides coated with rectangular pieces of looking-glass; it was suspended by a thread, with its axis vertical; torsion was imparted to the thread, and the prism acted upon by this torsion caused to rotate. It was so placed that its three faces received in succession the beam of light sent from the flame through the lens in front of it, and through the images upon the screen. On commencing its motion, the images were but slightly separated, but became more and more so as the motion approached its maximum. This once past, the images drew closer together again, until they ended in a kind of luminous ripple. Allowing the acquired torsion to act, the same series of effects could be produced, the motion being in an opposite direction.

In these experiments, that half of the tube which was turned towards the screen was coated with lampblack, so as to cut off the direct light of the jet from the screen.*

But what is the state of the flame in the interval between two images? The flame of common gas or of olefiant gas, owes its luminousness to the solid particles of carbon discharged into it. If we blow against a luminous gas flame, a sound is heard, a small explosion in fact, and by such a puff the luminousness may be caused to disappear. During a windy night the exposed gas-jets in the shops are often deprived of their light and burn blue. In like manner the common blowpipe-jet deprives burning coal gas of its brilliant light. I hence concluded, that the explosions, the repetition of which produces the musical sound in the case before us, rendered, at the moment they occurred, the combustion so perfect as to extinguish the solid carbon particles; but I imagined that the images on the screen would, on closer examination, be found united by spaces of blue, which, owing to their dimness, were not seen by the method of projection. This, in many instances, was found to be the case.

I was not, however, prepared for the following result:—A flame of olefiant gas, rendered almost as small as it could be, was procured. The 3-foot 2-inch tube was placed over it; the flame on singing became elongated and lost some of its light, still it was bright at its top; looked at in the moving mirror, a beaded line of great beauty was observed: in front of each bead was a little luminous star; after it, and continuous with it, a spot of rich blue light, which terminated and left, as far as I could judge, a perfectly dark space between it and the next following luminous star. I shall examine this further when time permits me; but, as far as I can at present judge, the flame was actually extinguished and relighted in accordance with the sonorous pulsations.

When a silent flame, capable, however, of being excited by the voice in the manner already described, is placed within a tube, and the continuous line of light produced by it in the moving mirror is observed, I know no experiment more pretty than the resolution of this line into a string of richly luminous pearls at the instant when the voice is pitched to the proper note. This may be done at a considerable distance from the jet, and with the back turned towards it.

The change produced in the line of beads when a tuning-fork capable of giving beats with the flame is brought over the tube, or over a resonant jar near it, is also extremely interesting to observe. I will not at present enter into a more minute description of these results. Sufficient, I trust, has been said to induce experimenters to produce the effects for themselves; the sight of them will give more pleasure than any description of mine could possibly do.

* Since these experiments were made, Mr. Wheatstone has drawn my attention to the following passage, which proves that he was the first to make use of the rotating mirror in examining a singing flame:—"A flame of hydrogen gas burning in the open air presents a continuous circle in the mirror; but, while producing a sound within a glass tube, regular intermissions of intensity are observed, which present a chain-like appearance, and indicate alternate contractions and dilatations of the flame corresponding with the sonorous vibrations of the column of air."—*Phil. Trans.*, 1834, p. 586.

For the Journal of the Franklin Institute.

Particulars of the Steamer Independence.

Hull built by Samuel Sneden. Machinery, by the Morgan Iron Works, New York. Superintending Engineer, Erastus W. Smith.

HULL.—

Length on deck from fore part of stem to after part of stern post,		140 feet.
Breadth of beam, (molded,)		26 "
" " over planking,		26 " 6 inches
" " over guards,		40 "
Depth of hold to spar deck,		10 " 3 "

Floor timbers at throats, molded, 14 inches;—sided, 10 and 12 inches;—distance between centres, 24 inches. Frames braced with diagonal iron bars 3½ by 9-16 inches, one to each frame, cross-laid and riveted at their crossings.

Draft of water in running trim,		6 " 9 "
Contents of bunkers in tons of coal,	30.	
Tonnage, custom-house,	400.	

ENGINES.—Two—Vertical beam.

Diameter of cylinder,		32 inches.
Length of stroke,		8 feet.
Cut-off variable from ¼ to full stroke.		
Maximum pressure of steam above the atmosphere, in pounds,	30.	
Maximum revolutions per minute,	25.	

PADDLE WHEELS.—

Diameter,		24 feet.
Length of paddles,		7 " 6 "
Depth "		1 " 8 "
Dip "		2 " 10 "
Number " in each wheel,	20.	
Material of wheels,	oak.	
Outside rims of iron, 3½ by 9-16 inches.		

BOILERS.—Two—Single return flued.

Length of boilers,		18 feet.
Breadth " front,		7 " 6 "
" " back end,		7 " 6 "
Number of furnaces in each boiler,	2.	
Breadth "		3 " 3 "
Length of grate bars,		6 " 6 "
Height of steam chimneys,		9 "
Internal diameter of "		3 " "
External " "		5 " 2 "
Diameter of smoke pipe,		4 " 4 "
Height "		28 "
Description of coal,	Bituminous.	
Draft,	Natural.	

Remarks.—The *Independence* was built by Captain Ezra Nye, of New York, for towing in the harbor of Valparaiso, S. A. She is single decked, with round stern; has high close bulwarks all around, which are solid forward and aft, a forcastle deck and half wheel guards. Is schooner rigged, and has no incumbrance on deck, except the pilot and engine house and wheel-houses.

The planking of the bottom, bilges, and sides, is of white oak, 3 ins. thick; square fastened with copper, and locust treenails. Ceiling is of 4 inch yellow pine. Deck beams are of yellow pine, 10 by 12 inches, 6 feet between centres, with lodger, bosom and hanging knees of hackmatack on each beam. Deck planks are of white pine, 3 inches thick. All subordinate parts are in proportion.

Engines are connected by a centre-shaft fitted with a connecting crank, which admits of their being worked separately or together. The boilers are fitted with connexion steam valves, admitting the connexion of either boiler, with either or both the engines.

Connected with the boilers is a large size independent "Worthington" steam fire and bilge pump, of a capacity of 800 gallons per minute, supplied with four branches for hose connexions and hose for extinguishing fire, and is to be used in Valaparaiso, as a floating steam fire engine. The vessel is also supplied with large iron tanks for fresh water, which by the aid of the steam pump will be supplied to vessels. E. W. S.

Coal and Iron in the Kingdom of the Two Sicilies.

The Neapolitan official journal speaks of the quantity of iron and coal with which the Kingdom of the Two Sicilies abounds, and anticipates the time when the country will be independent of the foreigner. With respect to coal, it says that several vast carboniferous barriers have been discovered, and that the one near Gerace is beginning to be productive. With regard to iron, the establishment of Mongiana and of Ferdinandea is spoken of with approbation, where, in six months of this year, 30,000 cantari of ghise (iron) are said to have been discovered. After three years of investigation in the Apennines, the mines of San Donato are said to have yielded 40,000 cantari of mineral, and those of Campoli the same. The mines of San Donato have four galleries. The mineral which is discovered there is of good quality, belonging to the "Limonite Ferro ossidato idrato." In the mines of Campoli, the mineral is of the same description, being an "idrossido di ferro." The report of General D'Agostino, the Inspector General, not a little expanded by the official journal, calls upon all Neapolitans to thank God for having bestowed on them a monarch to whom he has given such an energetic genius and so enlightened an intellect!

Original Omnibus.†

Who would have thought that the omnibus was an ancient institution; in fact, nearly two centuries old? Such, however, is the case, it appears. In 1662,—as we learn from the notes of a young and enterprising French contemporary, the *Courrier de Paris*,—a royal decree of Louis the Fourteenth authorized the establishment of a line of "two-

* From the London Athenæum, Sept., 1857. † *Ibid.*

penny-halfpenny" omnibuses; or "Carosses à cinq sous." The company had at its head the Duke de Roanès, and a brace of marquises, and no less a person than the gentle Pascal was among the shareholders. The decree expressly stated that these coaches, of which there were originally seven, each containing eight places, should run at fixed hours, full or empty, to and from certain extreme quarters of Paris, for the benefit ot "a great number of persons ill provided for, as persons engaged in law-suits, infirm people, and others, who have not the means to ride in chaise or carriage, which cannot be hired under a pistole or a couple of crowns a day." As the pistole was worth eleven francs, and the crown (écu d'or) was worth five francs fourteen sous, the idea of a two-penny-halfpenny omnibus spread delight throughout the capital. The public inauguration, at seven o'clock on a March morning, of the year 1662, was a grand and gay affair. Three of the "busses" started from the Porte St. Antoine, and four from the Luxembourg. Previous to their setting out, two commissaries of the Châtelet, in legal robes, four guards of the grand provost, half-a-score of city archers, and as many cavalry, drew up in front of the ecstatic people. The commissaries delivered to the latter an address on the advantages of the two-penny-halfpenny carriages, exhorted the riders to observe good order, and then, turning to the coachmen, covered the body of each with a long blue frock, with the arms of the King and the city showily embroidered on the stomach. With this original badge, off drove the coachmen, but throughout the day a provost guard rode in each carriage, and infantry and calvalry, here and there, paraded along the respective lines to keep them clear. For awhile, all Paris strove to ride in these omnibuses, and some stood to gaze impatiently at those who had succeeded better than themselves. The two-penny-halfpenny coach was *the* event of the day, even the *Grand Monarque* tried a trip in one down at St. Germains, and the actors of the Marais played the "Intrigue des Carosses à cinq sous," on their joyous theatre. The wealthier classes seem to have taken possession of them for a considerable time, and it is singular that when they ceased to be fashionable, the poorer classes would have nothing to do with them, and so the speculation failed. The system re-appeared, we may add, in London, under certain modifications, in the year 1820, and as in Paris in 1662, so in London, we brought the new carriage on the stage, and drew peals of laughter and a heavy "half price," by the farce of "The Omnibus; or, a Convenient Distance."

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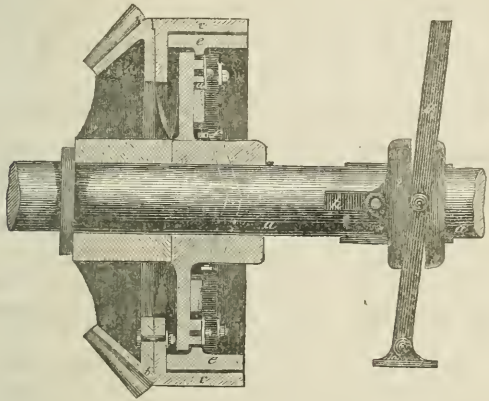
*Wrigley's Improved Friction Coupling for the transmission of Motive Power.**

Mr. Francis Wrigley, of Long Island Iron Works, Carlisle, has patented a highly ingenious arrangement of machinery to be applied, either internally or externally, to a frictional surface on a wheel or disk in motion, by which means it is brought gradually into contact within another and similar surface at rest, and thus held without any other restraining force, and thereby made capable of transmitting any amount of power

* From the Lond. Mech. Mag., Aug., 1857.

from the prime mover to any shafting, gearing, or other machinery requiring to be alternately set in motion or remain at rest. This is accomplished without shock or concussion to any part of the said shafting, gearing, or other machinery.

The accompanying engraving is a sectional view, taken through the centre of the coupling, showing the arrangement of rods, links, lever, and sliding box ; *a*, is the shaft, upon which (when at rest) revolves the bevel wheel, *b*, or other driving wheel or drum, and attached to which is the metallic rim, *c; d*, *d*, are slots in the flanches of the frictional surface plates, *e*, *e*, and which surface plates are brought into contact with the rim, *c*, by the rods, *f*, *f*, shown partly in dotted lines, actuated by the lever, *g*, through the connecting link, *h*, also partly shown in dotted lines, and the grooved boss, *i*, which slides on feathers sunk on the shaft, *a*.



Supposing the driving wheel to be at rest, and it is required to impart an intermittent motion thereto, that is, to stop or start the said wheel at intervals : the wheel is not secured upon the shaft, but fits loosely thereupon, the apparatus for coupling the wheel with the driving power being firmly secured upon and revolving with the said driving shaft. The lever, *g*, is moved forward, either by screw power or otherwise, which causes the boss, *i*, to slide along the shaft, *a*, and by means of the links, *h*, to press the ends of the links, *f*, *f*, nearest the centre or shaft, into a line, or nearly so, with their extreme centres ; this has the effect of extending the revolving frictional surfaces, *e*, *e*, and thus bringing these surfaces into contact with the rim, *c*, and imparting motion thereto by the friction created between the said surfaces and the rim, and consequently to the wheel desired to be driven. It will be evident that the wheel may be disconnected from the driving power by reversing this action and withdrawing the fractional surfaces from their rim.

On a Law of Temperature depending upon Lunar Influence. By Mr. J. P. Harrisson.*

The author commenced by saying that, although the question of lunar influence on the atmosphere of our planet was very generally considered as set at rest by the investigations of M. Arago, yet he felt very confident that he was in a position to prove the law he was now about to announce without fear of contradiction. He had reduced and thrown into the form of tables and of curves 280 lunations, with the corresponding mean temperatures ; and the laws at which he had arrived were, first, between the first and second octant the temperature immediately after the first quarter, both on the average, and also, with rare exceptions, in each individual lunation is higher than the temperature shortly before the first quarter; secondly, and more particularly, the mean temperature of the annual means of the second day after the first quarter (or the tenth day of the moon's age) is always higher than that of the third day before the first quarter (or the fifth day of the lunation). The tables and curves accompanied the essay, which illustrated these laws at great length.

On the Influence of Metals upon Radiant Heat.† By H. Knoblauch, Prof. Nat. Philos. in Halle.

The principal results of this investigation may be stated to be as follows:

1. Metals, as gold, silver, and platinum, when in thin layers, are to be regarded as diathermanous bodies, which permit a portion of the calorific rays to pass through them ; which portion naturally becomes less as the thickness of the layer increases.

In thus transmitting the calorific rays, certain metals, as gold and silver, exercise an elective absorption, similar to that of colored transparent bodies upon light. Others, on the contrary, like platinum, act in the same manner upon all rays, and are therefore to be regarded as analogous to colorless bodies in the case of light.

2. In the case of diffuse reflexion, also, certain metals, such as gold, silver, mercury, copper, and brass, similar to colored and opaque bodies as regards light, exercise an elective absorption upon the calorific rays, in consequence of which the properties of the latter are altered. Others, on the contrary, for example, platinum, iron, tin, zinc, lead, alloy of lead, and tin, German silver, reflect all kinds of calorific rays in the same proportion, exactly as colorless opaque bodies do with regard to light.

The properties which distinguish calorific rays reflected from metals, from unreflected heat, are so far dependent on the source of heat, that differences, for example, which exhibit themselves in a striking manner when solar heat is made use of, are diminished in the case of a Locatelli lamp, and completely disappear when the source of heat is a metallic cylinder not heated to redness.

The surface has the power either of causing the differences to appear in their maximum degree, or to disappear totally, according as the surface produces a diffuse or a regular reflexion.

* From the London Athenæum, Sept., 1857.

† From the Lond., Edin., and Dub. Philos. Mag., Nov., 1857.

The same is true of the change of the angle of incidence. In the case of a rough metallic surface, as the angle of the rays with the surface diminishes, the reflexion passes gradually from the diffuse to the regular, and at the same time the differences between the reflected and unreflected heat also gradually become less, until finally both have exactly the same character.—*Poggendorff's Annalen*, vol. ci., 1857.

Photographing a Drawing upon the Wood on which it is to be Engraved in Relief. Process of M. LALLEMAND.

The wood is first placed with its surface on a solution of alum, and dried; it then receives with a soft brush, a coating composed of animal soap, gelatine, and alum, upon all its faces; when the coating is dry, the surface which is to receive the picture is placed for some minutes in a solution of muriate of ammonia (sal-ammoniac), then dried; then on a bath of nitrate of silver of 20 per cent., and then dried. A clichè upon glass or paper is then applied on the wood by means of a peculiar frame permitting the process of the reproduction to be watched. When satisfactory, the picture is fixed by means of a saturated bath of hyposulphite of soda. A few minutes is enough; it is then washed for only five minutes. The first coating preserves the wood from moisture; and eight months of experience have proved to the inventor that the employment of alum and a hyposulphite, in place of destroying the wood, gives it a great strength favorable to the engraving.—*Comptes Rendus de l'Academie des Sciences* (*Paris*), October, 1857.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, November 19, 1857.

John Agnew, Vice-President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from Thomas Oldham, Superintendent or the Geological Survey of India, and the Geological Museum, Calcutta, India, and L. A. Huguet-Latour, Esq., Montreal, Canada.

Donations to the Library were received from the Government of India; The Austrian Engineers' Association, Vienna, Austria; L. A. H. Latour, Montreal, Canada; The City of Boston, Mass.; The Hon. J. Holt, Commissioner of Patents, Washington City, D. C.; The American Pharmaceutical Association; Prof. B. Howard Rand, M. de Villeroi, N. F. Jones, Philip Price, James A. Price, Trustees of the Philadelphia Gas Works, and the Mine Hill and Schuylkill Haven Railroad Co., Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of November was read.

The Board of Managers and Standing Committees reported their minutes.

New candidates for membership in the Institute (16) were proposed, and the candidate (1) proposed at the last meeting was duly elected.

Ellwood Morris, C. E., exhibited a large drawing of "*Walker's Combined Counter-braced Arch and Truss Bridge.*" This ingenious bridge was designed by Major Robert Walker, Chief Engineer of the North Missouri Railroad, and erected under his direction, at Perruque Creek, (as shown in the drawing,) in two spans of 150 feet each, and at other places. This bridge has proved itself in practice under heavy railroad trains, *to be both strong and stiff in a remarkable degree;* it fulfils all the conditions of a good railroad bridge, and is highly creditable to the professional skill of its projector.

A striking peculiarity in this bridge is shown in the arrangement of the truss rods—these are not only in pairs on each truss, but are divided at the arch, where they separately take hold of a cast iron saddle, so that by acting upon screws cut both on top and bottom of the truss rods, the strains produced by the bridge and its load may at will be thrown either upon the arch, upon the truss, or divided between the two, *so as to bring into play the utmost strength of both.*

Dr. Rand exhibited specimens of parchment paper, prepared by the process published in the *Journal of the Institute*, August, 1857, p. 135.

M. de Villeroi exhibited his "Harmonine," a new musical instrument. It is under consideration by the Committee on Science and the Arts, and will be further noticed in a future number of the *Journal.*

Mr. Howson exhibited a model of a safe for preserving valuables at sea. It consists of a metal vessel composed of an inner and outer casing.

Mr. Howson also exhibited an apparatus for testing the strength of materials, invented by F. C. Lowthorp, Esq., C. E., of Trenton, N. J., and patented in the United States, England, France, and Belgium. The machine is designed for ascertaining the amount of tensile and transverse strain, or torsion or crushing effect which materials are capable of withstanding, and consists in so combining suitable gearing and other mechanism for applying the strains or forces with a piston or plunger, operating against a body of water, or other fluid within a cylinder or barrel, that on applying the force or strain to the object to be tested by means of the gearing, such a pressure shall be transmitted to the fluid in the cylinder or barrel, and to any suitable indicating apparatus in connexion with the same, as to enable the attendant to readily calculate the amount of strain or force to which the object has been submitted.

Mr. Howson remarked that the wrought iron work of the extensive girder bridge over the Jordan River, in Lehigh Co., Pa., was tested by a machine similar to, but on a larger scale than, the one exhibited, and that the machine proved to be most efficient and rapid in its action.

Mr. H. also exhibited a very ingenious automatic rake for harvesters, the invention of S. Comfort, Jr., of Morrisville, Bucks Co., Pa.

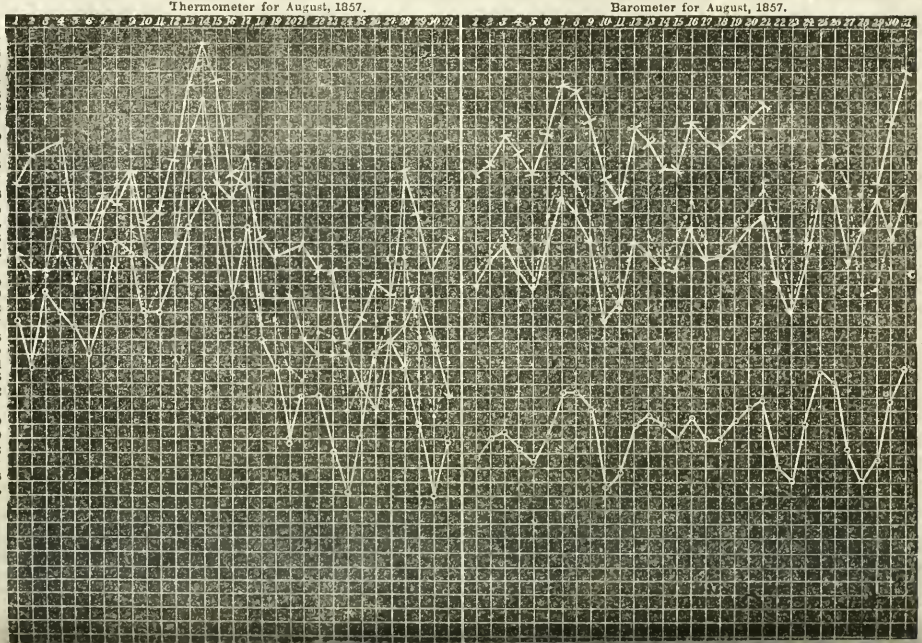
ERRATA.

Page 200, line 11 from bottom, for "addition specific heat," read "specific heat when in that state."
201, line 5 & 6 from top, for "water or density," read "water of the same density."
" 13 " "3·576° C.," read "3·576 atmospheres."
" 16 " "(=60 per cent.,)" read "(60° C.)"

Abstract of Meteorological Observations for September, 1857, made in Philadelphia, Somerset, Huntingdon, and Northampton Counts Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

September, 1857.	Philadelphia.—Lat. 39° 57′ 25″ N, Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. Kirkpatrick, Observer.									Somerset, Somerset Co.—40° N., Lon. 79°3′W. Height about 2750 ft. Geo. Mowry, Observer							Easton, Northampton Co.—Lat. 40°43′N. Lon. 75° 16W. Height above the sea about 320 feet. Selden J. Coffin, Observer.							Huntingdon, Huntingdon County. Jacob Miller, Obsr.		
	Barometer.		Thermometer.			Relative humidity.	Force of vapor.	Rain.	Prevail'g winds.	Barometer.		Thermomet'r.		Rain.	Prevail'g winds.		Barometer.		Thermomet'r.		Rain.	Prevail'g winds.	Ther.	Rain.	Prevail'g winds.
	Mean.	Mean daily range.	Mean.	Daily range.	Mean daily range.	2 P. M.	2 P. M.			Mean.	Mean daily range.	Mean.	Mean daily range.				Mean.	Mean daily range.	Mean.	Mean daily range.			Mean.		
	Inch.	Inch.	°	°	°	Per ct.	Inch	Inches.		Inch.	Inch.	°	°	Inches.			Inch.	°	°	°	Inch.		°	Inch.	
1	30·101	·096	76·2	22	3·8	51	·564		N W.	27·942	·062	63·3	4·6		S.		29·810	69·8				W.	66·5		S.
2	30·130	·023	75·8	20	1·0	51	·564		S E.	27·956	·005	68·3	5·0		S.		29·810	0·002	69·5	0·3		(var.)	68·5		S.
3	30·138	·008	76·5	17	2·2	46	·479		S E.	27·976	·020	66·0	2·3		S S E.							W.	69·0		S.
4	30·124	·014	76·0	18	0·8	41	·437		(var.)	27·955	·021	66·3	1·7		S W.							(var.)	70·0		S.
5	30·060	·124	78·3	17	2·3	54	·648		(var.)	27·862	·092	67·0	0·7		W.		29·637		73·8			N W.	73·0		W.
6	29·935	·126	73·2	16	5·2	32	·321		N W.	27·823	·081	61·0	8·0	0·304	N W.							N E.	69·0		N E.
7	30·150	·215	63·8	17	9·3	34	·255		N E.	27·967	·144	52·3	9·3		E.		29·837		56·3			(var.)	55·0		E.
8	30·262	·073	63·7	23	1·8	42	·344		(var.)	27·995	·028	53·7	1·3		S.		29·883	0·007	57·0	2·7		(var.)	56·0		S E
9	30·064	·139	64·0	21	4·3	49	·456		S S W.	27·888	·106	59·0	5·3		W.							(var.)	62·5		S.
10	29·973	·090	71·2	25	3·2	49	·533		S W.	27·815	·074	65·3	6·3		S W.		29·617		67·3			(var.)	69·0		S.
11	29·921	·052	75·7	22	4·5	56	·535		S W.	27·781	·033	68·0	2·7		W.							W.	71·5		S.
12	29·894	·028	74·0	20	1·7	60	·676	0·034	(var.)	27·742	·040	67·0	1·0		S S E.		29·573		67·0			E.	73·0		S.
13	29·857	·040	71·3	8	4·0	81	·666	0 011	E.	27·698	·044	71·0	4·0		S E.		29·547	0·040	66·0	3·0		N E.	71·0		E.
14	29·718	·140	76·2	12	4·8	70	·764	0·009	N E.	27·650	·048	69·7	4·0		(var.)		29·397	0·150				(var.)	67·5		E.
15	29·805	·118	74·2	14	2·7	34	·347		N W.	27·774	·124	61·7	8·0		N W.		29·483	0·107	66·3			N W.			N.
16	29·979	·175	68·7	19	5·5	43	·362	0·020	N W.	27·781	·091	58·0	12·3		S.		29·640	0·157	61·5	4·8		W.	67·5		S.
17	29·723	·256	77·0	20	8·3	63	·659		S W.	27·631	·150	75·7	17·7	0·420	W.		29·350	0·283	71·0	9·5		S W.	77·0	0 554	W.
18	29·795	·162	75·8	11	6·2	54	·536		N W.	27·661	·033	69·3	6·3	1 469	W.		29·453	0·170	66·0	9·0		N W.	65·0	0·195	N.
19	29·825	·139	60·0	10	15·8	87	·399	0·524	N E.	27·588	·073	64·0	5·3	0·941	S.		29·550	0·143	48·3	17·7		(var.)	56·5	1·300	N.
20	29·778	·091	61·8	12	5·8	73	·470		N.	27·629	·095	56·0	8·0		W N W		29·420	0·137	57·5	9·2		N W.	56·5		N.
21	29·954	·176	64·7	13	5·0	52	·366		N E.	27·763	·133	51·0	6·3		(var.)		29·620	0·200	54·3	3·2		N.	57·0		S E.
22	29·778	·175	63·5	12	2·5	66	·443	0·513	S E.	27·592	·170	55·0	5·3	0·198	(var.)		29·440	0·180	57·0	3·3		S E.	55·0	0·328	S E.
23	29·732	·167	61·5	12	2·0	58	·296		W.	27·613	·062	48·0	7·0		(var.)		29·357	0·157	51·3	6·3		(var.)	50·0		W.
24	29·916	·184	60·7	22	3·5	41	·308		S W.	27·737	·124	51·7	9·0		W.		29·557	0·220	51·7	9·0		W.	55·5		S W.
25	29·938	·032	62·0	20	1·3	45	·339		N W.	27 785	·049	53·3	1·7		N.							N W.	57 0		S.
26	29·943	·030	69·0	26	7·0	50	·477		(var.)	27·853	·068	56 7	3·3		W N W		29·620		59·7			W.	65·0		(var.)
27	29 978	·032	73·7	21	5·3	48	·538		N W.	27·833	·045	59·0	3·0		S W.		29·620	0·000	66·9	6·3		W.	63·5		S W.
28	29·789	·172	69 7	20	4·0	47	·404		W.	27·722	·111	55·7	7·3		W.							W.	57·0	0·017	W.
29	29·627	·138	59 8	14	9·5	33	·201		W N W	27·566	·084	42·3	13·3	0·007	W.							N W.	49·5		N.
30	30·002	·075	53·3	20	6·5	46	·255	0·021	N W.	27·827	·022	41·0	2·7		(var.)		29·653		45·0			W.	48·5		N W.
Me's	29·936	·109	69·2	17 5	4·7	51	·460	1·132	N 83°W	27·788	·074	60·0	4·8	3·279							1·07			2·454	

Comparison of the Thermometric and Barometric Means of Philada., Northampton, Somerset, and Huntingdon Counties.



EXPLANATION.—
Those marked o—o Somerset County. Those marked +—+ Philadelphia County.
" ·—· Northampton " " <—< Huntingdon "

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REPORT

ON THE

Twenty-Fifth Exhibition

OF

AMERICAN MANUFACTURES,

HELD IN THE CITY OF PHILADELPHIA,

FROM THE 11TH TO THE 29TH DAY OF NOVEMBER, 1856.

BY

THE FRANKLIN INSTITUTE,

OF THE

State of Pennsylvania, for the Promotion of the Mechanic Arts:

TOGETHER WITH A

CATALOGUE OF THE ARTICLES DEPOSITED

PREVIOUS TO NOVEMBER 10, 1856.

AND

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1857.

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5 Invoice, Surgical Bandages. Made and Dep. by Dr. M'Clenaghan.
6 Map, United States. Made and Deposited by C. E. Fritz, Phila.
7 Invoice, Leathers. Made by Halsey & Taylor, Newark, N. J. Dep. by I. J. Barton & Co., Phila.
8 Invoice, Pickles and Preserved Fruits. Made and Deposited by M. B. Espy, Phila.
9 Map. Made and Deposited by J. Anspach, Phila.
10 Invoice of Furniture Polish. Made and Deposited by Saml. Rue, Phil.
11 Case Transparent Soap. " " A. Brocard, "
12 " Model Windsor Chairs. " " Danl. L. Stoud, Phila.
13 Invoice, Clocks. Various Makers, Deposited by Elias Smith, Phila.
14 1 Pyramid Ostrich feathers Brushes. Made and Deposited by L. G. Hansen & Co., Phila.
15 1 Chromatic Painting. Made and Dep. by Julia F. Morplus, Phila.
16 1 Lot Hay and Manure Forks. Made and deposited by Sheble & Lawson, Phila.
17 1 Case Coffee Mills. Made and Dep. by Ridgway, Selson & Ruff, Phila.
18 2 Bundle Binders' Boards. " " Theo. Megargee, "
19 1 Lot Agricultural Implements. Made and Dep. by Smith Harper, Fox Chase, Pa.
20 Lot Slates. Made by Lehigh Slate Co. Dep. by D. D. Jones.

21 Lot Telegraphic Instruments. Made by Hinds & Williams, Boston. Dep. G. P. Thayer.
22 Habilimentary Toilet. Made and Dep. by David Freed, Phila.
23 Roll Saddle Skirting. Made by Jacobus & Co., Newark. Dep. by W. Musser & Co., Phila.
24 Case Liquid Paste Blacking. Made and Dep. by Home & Beal, Balt.
25 Case Patent Knife and Scissor Sharpener. Made and Deposited by J. Young, Phila.
26 Case West Indian Tooth Powder and Wash. Made and Dep. by R. B. Da Costa & Son, Phila.
27 Piece Embroidery. Made and Deposited by Mrs. Robinson, Phila.
28 Card Carriage Bolts. " " Thos. J. Kelly, "
29 Thurst Bearing for Propeller. Made and Dep. by Geo. Parry, Phila.
30 Frames Specimens of Writing. " " S. H. Crittenden, "
31 Case of Chemicals. " " J. E. Carter, "
32 Mathematical Instruments. " " H. U. Poole, Pottsville, Pa.
33 Specimens Collars. " " Tho. Fry, "
34 Bed Quilt. Made by Mrs. Dr. Piercell, Ohio. Dep. by J. Bush, "
35 Atmospheric Engine. Made and Deposited by M. N. Fredricks, "
36 Lot Stair Rods and Taper Holder. Made and Dep. by Willer & Moss, Phil.
38 Asst. Chemicals. Made and Deposited by Carter & Scattergood, Phil.
39 Sample Card Envelopes. " " R. T. Knight. "
40 Sample Loops for Harness. Made and Dep. by E. G. Chorman, "
41 Lot Chandler and Grocer Wicks. Made by W. Chadwick, Lower Merion. Dep. by J. D. Fisler, Phila.
42 Case Cocoanut Shell Baskets. Made and Dep. by W. Williams, Phila.
43 Lot Hardware. " " Justice & Steinmetz, "
44 2 Frames Needle Work. " " Miss M. E. Robins, "
45 Pair Windsor Shades. " " Martin Free, "
46 Frames Card Seals. " " E. F. Baton, "
47 Case Indian Vegetable Salve. " " Mrs. E. Cline, "
48 Lot Frost Proof Silver Letter. " " J. Wishart, "
49 2 Cases Philosophical Apparatus. " " W. H. Pile, "
50 4 Doz. Glass Preserving Jars. " " A. Stone & Co., "
51 2 Boxes Soap. " " Barry & Boyd, "
52 Piano Cover. " " Miss E. Isaacs, "
53 Piano Cover. Made by Miss Ellen Myers, New Bristol, Bucks Co., Pa. Deposited by Miss A. E. Carpenter, Phila.
54 Lot Worsted Work. Made and Dep. by R. W. Renshaw, Phila.
55 2 Boxes White Water Lily. Made and Dep. by J. C. De La Cour, Camden, N. J.
56 Lot Essence Ginger. R. B. Heintzelman.
57 Case Thermometer. Made by L. B. Swan, Rochester, N. Y. Dep. by R. H. Douglass, Phila.
58 Lot Statuary. Made and Dep. by J. & H. Johnson, Phila.
59 Lot Gas Meters. " " Code, Hopper & Co., Phila.
60 Case Machinist Tools. Made by Darling & Shwartz, Bangor, Me. Dep. by Field & Hardie, Phila.

61 Lot Self-Generating Gas Lamps. Made and Dep. by Dr. C. A. Greene, Phila.
62 Case Branding Irons. Made and Dep. by John Franklin, Phila.
63 Case Carpenter Tools. " " Thos. L. Moss, "
64 1 Case Hardware. " " Charles Disston, "
65 1 Case Hardware. " " Henry Disston, "
66 Fancy Work Box. " " G. R. Vanacken, "
67 Case Hats and Caps. " " New Hat Co., "
68 Lot Ambrotypes and Daguerreotypes. Made and Dep. by H. Willard, Phila.
69 2 Crayons Drawing. Made and Dep. by L. Cohen, Phila.
70 Stitch Quilt. Made by Mary M'Clain. Dep. by R. Griffith.
71 Leather Work Frame. Made and Dep. by Mary Asten, Phila.
72 2 Drawing Locomotive. " " G. W. L. Speis, "
73 Papier Mache Painting. " " Frank Vincent, "
74 Locomotive Drawing. " " Saml. Bower, "
75 Case Embossed Cards. " " W. F. Schieble, "
76 Case Oyster Knives. " " S. P. Miller, "
77 Oil Painting. " " H. A. Uhle, "
78 Lot Perfumery, &c. " " E. M'Clain, "
79 3 Crayons Painting. " " R. F. Reynolds, "
80 3 Case Stuff Birds. " " John Krider, Jr., "
81 Oil Painting. " W. J. Rodger. Dep. by J. Bard, Phila.
82 Tin Ship Flying Yankee, " " Henry B. Butcher, Phila.
83 1 Ship. Jas. Smith, U. S. N. Asylum, Phila. Dep. by B. M. Toole.
84 Spanish Military Saddle. Francis Fox, Phila. W. S. Hansell & Son, Philada.
85 1 Lot Crochet Work. Miss A. B. Warrington, Camden.
86 Patent Crimping Machine. Geo. Fetters, Holmesburg.
87 Watchman's Clock. Howard & Davis, Boston. Dep. by E. Holden, Phil.
88 1 Hose Carriage, Pole Crab, and Plug Wrench. Young & Son, Phila.
89 1 Case Fancy Embroideries. Kirchner, Philada.
90 Pat. Bank Lock. J. M. Butterworth, Dover, N. J. James Watson, Phil.
91 1 Crochet Counterpane. Made and Dep. by W. Knoneke, Phila.
92 Maps. L. Newkirk, Philada.
93 Case Chemicals. H. A. Bower, Philada.
94 1 Case Wax Fruit Flowers. Mrs. J. Carris, Philada.
95 1 Crayon Drawing. Wm. R. Overman, Philada.
96 3 Drawings. Henry Karfering, Philada.
97 Show Case. D. K. & S. D. Large, do.
98 3 Young America Fluid Lamps. Alburger & Wood, Philada.
99 1 Card Brass Cocks. Morrison & Ray, Philada.
100 1 Case Millinery. M. Elshurg, Philada.
101 1 Lot Hinges. E. Woolman, Phila., John Woolman, Phila.
102 2 Oil Paintings. Chas. Keelman, Phila.
103 1 Lot Citrate Magnesia. S. C. Sheppard, Phila. E. Sheppard, Phila.
104 1 Imitation Rose Wood. W. B. Snyder, do.
105 1 Lot Shovels and Spades. Maxwell & Rowland, Holmesburg.
106 2 Drawings. J. Snowden Bell, Phila.

107 1 Shell Pyramid. T. A. Brown, Phila.
108 Case Skates. Newark Skate Co., Newark, N. J. W. W. Knight, Agent, Phila.
109 1 Lot Druggists' Scales and Weights. H. Troemmer, Phila.
110 1 Diaphanous Painting. L. G. Reed, Phila.
111 1 Case Patent Yankee Match Stands. C. O. Wilson, Phila.
112 1 Case Zephyr Work. Anna Edwards, Phila.
115 3 Circular Saw Handles. L. Vanseiver, do.
116 1 Marble Box and Book. Jos. Collahan, Phila.
117 1 Local Anæsthesia. E. C. Stockton, Phila.
118 1 Frame Imitation Pearl Work. Bishop & Bevan, Phila.
119 Bed Quilt and 3 Jars Pickles. R. H. Griffith, do.
120 4 Cases De Laines. Hamilton Woollen Co., Southbridge, Mass. Lafourcade, Cox & Co., Phila.
121 2 Cases Hats, Caps, and Furs. Foster & Gebhard, Phila.
122 1 Silk Spread. Mrs. E. Hanning, Phila.
123 1 Case Patent Accordeons. A. Faas, Phila. J. Servoss, Phila.
124 1 Embossed Head. F. C. Key & Son, do.
125 1 Case Die Sinking. do. do. do.
126 Collection Fine Chemicals. Hennell Stevens, Phila.
127 12 pieces Fancy Cassimeres. Millville Manufacturing Co., Millville, Mass. Farnham, Kirkham & Co., Phila.
128 5 pieces Fancy Cassimeres. Merrimac Woollen Co., Dracot, Mass., Farnham, Kirkham & Co., Phila.
129 5 pieces Fancy Cassimeres. Broadbrook Manufacturing Co., Connect. Farnham, Kirkham & Co., Phila.
130 2 Frames Fancy Zephyr Work. G. R. K. Hirst, Phila.
131 1 Crochet Tidy. G. R. K. Hirst, Phila.
132 Rose Allendale Quilt. Emily A. Humphries, Phila.
133 1 Jar Cyanide of Potassium. H. W. Worthington, Phila.
134 1 Stone Lined Water Cooler and Letter Press. Oliver Evans, Phila.
135 Needle Work, Washington Family. S. Milton, Phila.
136 Lot of Light Coloured Card Boards. A. M. Collins & Co., Phila.
137 4 Pictures. Robt. Love, Phila.
138 1 Case Fancy Bead and Brush Work. Pennsylvania Blind Asylum, Phila.
139 1 Box Dry Goods. W. A. Howard, Providence, R. I. Fales, Lathrop & Co., Phila.
140 1 Lot Maps. N. W. Grammar School, Phila.
141 10 Window Shades. J. R. Ray, Phila.
142 2 Pictures. Geo. Dickson, Phila.
143 1 Map. T. H. Woodward, Phila.
144 1 Picture. W. J. Rodgers, Phila. Chas. Worrell, Phila.
145 4 Cases De Laines. Manchester Print Works, Manchester, N. H. J. C. Howe & Co., Phila.
146 1 Lot Essence Coffee. Eli Krupp, Phila.
147 1 Lot Trusses and Surgical Instruments. C. Marsh & Co., Phila.
148 1 Frame Hair Work. Mary Sover, Phila.
149 3 Bed Covers. George F. Smith, Phila.

150 Gas Generator and Gas Holder. N. Aubin, New York.
151 1 Carved Figure. Francis Fox, Phila.
152 2 Bed Quilts. Susannah Johns, Chambersburg, Pa.
153 1 Case Galvanic Batteries. Dr. S. B. Smith, N. Y. Dr. W. H. Hazzard, Phila.
154 1 Case Hats. W. F. Warburton, Phila.
155 1 Case Canes and Fancy Ivory Turning. Geo. Doll, Phila.
156 6 pieces Table Diaper. John Whitesides, Phila.
157 1 Lot Boot and Shoe Lasts and Trees. Jacob Foster, Phila.
158 1 Case China. C. Fraser, Phila.
159 1 Lot Preserving Cans. Arthur Burnham & Co., Phila.
160 1 Lot Shawls. Jas. Roy & Co., N. Y. Wood & Erringer, Phila.
161 1 Lot Muslins. Wamsutta Mills, New Bedford. Wood & Erringer.
162 1 Case Bed and Crib Blankets. Newitchawanock Co. Pease & Brown, Phila.
163 1 Gross Razor Powders. Robert Jones, Phila.
164 Masonic and Fancy Jewelry. Edgar F. Baton, Phila.
165 1 Lot Moulding Designs and Patterns. G. Pellman, Phila.
166 1 Spanish Hunting and Miniature Saddle. Francis Fox, Phila.
167 1 American Plumbago. Plumbago Co. Saml. Webb.
168 1 Case Embroideries. Mrs. J. C. Wright, Phila.
169 4 Boxes Ferruginous Chocolate. E. Pincus, Phila.
170 4 Bottles Mustard. E. Pincus, Phila.
171 4 Rolls Chocolate. " "
172 1 Case Patent Leather Collars. W. R. Scott, Phila.
173 1 Case Gilt Mouldings. Thery & Krause, Phila.
174 7 Stereoscope Daguerreotypes. J. F. Mascher, Phila.
175 18 Gold Daguerreotypes. J. F. Mascher, Phila.
176 10 Stereoscopic Books. " "
177 8 " Skeleton Books. " "
178 1 " Fancy Shell Box. " "
179 1 " Mahogany Work Box. J. F. Mascher, Phila.
180 4 " Boxes G. S. Mounted. " "
181 3 Stereoscopic Porte Mounaies. J. F. Mascher, Philadelphia, maker.
182 12 Magnifying Daguerreotype Cases. do do do
183 2 Model Cottages. Wm. Carson, Philadelphia. Frank Major.
184 1 Cask American Fertilizer. G. A. Lineau, Philadelphia, maker.
185 1 do Phosphate Lime. do do do
186 1 Fancy Shell Work-Box. C. W. Bolton, do do
187 1 Etching. C. Collis, Philadelphia, maker.
188 Fancy Paste Board Work. D. Lewis, Philadelphia, maker.
189 1 doz. Sugar Worm Lozenges. Dr. Wieland, Allentown, Pa. Hoffman & Moritz.
190 8 pieces Canton Flannel. S. Riddle, Delaware county, Pa., maker.
191 2 cases Embroideries. Miss Stern, Philadelphia, maker.
192 Case Mathematical Instruments. H. Hartman, Philadelphia, maker.
193 Lot Patent Leather Collars. J. Becher, do do
194 do Soaps. J. R. Graves & Co. Philadelphia, makers.
195 Model Ship. J. R. Ritter, do do

196 Lot Clothing. T. P. Dill & Co. Phila. Makers.
197 50 balls Webbing. S. Levin, do do
198 1 case Hair Jewelry. Miss A. Green, Phila., do
199 6 pieces Tweeds. Elm Street Manufacturing Company, Providence, R. I. F. G. Swan.
200 6 pieces Fancy Cassimeres. Seaton Wareham, Print Manufacturing Company, Connecticut. F. G. Swan.
201 Crayon Drawing. Walter Kidder, Philadelphia, maker.
202 Lord's Prayer. Wm. Hunt, do do
203 Lot Glass Plate and Roofing Glass. Philadelphia Glass Company, Philadelphia. W. P. Walter.
204 2 cases Roofing Slate. Peach Bottom Slate Company, Philadelphia, S. D. Bodine, President.
205 Bed Quilt. Mrs. Peters, Philadelphia, maker.
206 Case of Embroideries. E. Grosjean, Philadelphia, maker.
207 Electro-Magnetic Machine. W. H. Weekes, do do
208 Lot Dry Goods. D. Longenecker, Lancaster, Pa. J. Farnum & Co.
209 Painting. A. Schoneman, Philadelphia, maker.
210 Case Family Syringes. Mattson & Co. Philad. makers.
211 Case Ladies' and Children's Furnishing Goods. M. A. Jenks, Philadelphia, maker.
212 Case Wax Fruit and two Vases. Mrs. R. Bunn, Philad., maker.
213 Dental Case. Thos. Wardle, Philadelphia, maker.
214 Case Stammering Instruments. R. Bates, do do
215 Frame and Picture. E. Thompson, do do
216 2 do do. I. S. Ribben, do do
217 Chess Board and Case. D. Keyser, do do
218 6 Window Shades. J. L. Isaacs & Bro. do do
219 Case Gilt Mouldings. F. Gabylewitz, do do
220 2 Frames and Drawings. D. R. Knight, do do
221 Case Fancy Shirts. Mrs. Schaffer, do do
222 do Cigars. C. C. Bostwick, do do
223 Invoice Hardware. P. & F. Corbyn, New Britain. Miller & Wood.
224 Lot Fine do B. Martens, Philadelphia, maker.
225 Glass Show Case. F. Haffner, do do
226 Movable Planisphere of the Heavens. H. Whitall, Philad., maker.
227 Lot Copying Paper. Spring Lawn Mills, Philad. H. J. Brackney.
228 Lot Back and Hand Saws. Quaker City Saw and Shovel Works, Philad., makers.
229 Case Spool Cotton. B. J. Shreve, Mount Holly, N. J. maker.
230 Zephyr Portrait. Mrs. A. B. Linderman, Philadelphia, do
231 Case Plasters. W. H. Pratt, do do
232 5 pieces Table Damask Diaper. C. Porter, do do
233 Lot Dry Goods. James Long, do do
234 Bed Quilt. Ellen Paynter, do do
235 Map of the World. George G. Morton, do do
236 Lot Chemicals. Rosengarten & Sons, do do
237 3 Cards Friction Rollers. Albertson & Douglass, N. London. J. Morton.
238 2 Match Safes. L. Willard, Philadelphia, maker.

239 3 Boxes Soda Fountain Draft Apparatus. H. Morse, Boston, and F. Morris Perot.
240 1 Box Carved Wood Work. S. A. Adams, Philadelphia, maker.
241 4 pairs Medical Saddle Bags. J. S. Miller, do do
242 2 Paintings. Miss Chapman, do do
243 1 Counterpane. Mrs. C. Merriam, Philad. C. J. Merriam.
244 Lot Chemical and Pharmaceutical Preparations, Philad. E. H. Hance.
245 2 pieces Needlework. Miss Williams, do maker.
246 2 Plates Written Music. J. Kennedy, do do
247 1 Case Liquid Glue. W. C. M'Rea, do do
248 Invoice Cattle Powder. J. D. Pierce, do do
249 Map Adjuster. Wm. Scott, do do
250 Lot Mineralogical Specimens. J. W. Cadbury, do do
251 Sole Leather House. W. Huston, do do
252 Imitation Rosewood. J. N. Snyder, do do
253 Medical Battery. C. T. and J. W. Chester, New York. J. D. Knight.
254 Rail Road Signal. J. Busser, Philad. maker.
255 Case Porcelain Teeth. John Klein, Philadelphia, maker.
256 Lot Blank Books, from Shelves. Wm. Mann, 34 S. 3d St., Phila.
257 Vase Leather Fruit. Anna M. Melvin.
258 Patent Self-Measuring Cocks. J. A. Morris, Philada. J. W. N. Huntingdon.
259 Drawing. Jacob Burgam, do J. J. Walto.
260 Toilet Frame Looking Glass. G. S. Senatz, do maker.
261 Frame Sample Cut Glass. French & Richards, do do
262 16 pieces Assorted Cottonades. Joseph Ripka, do do
263 2 Cases Candles. Thain & McKeon, do do
264 1 Masonic Chart. James Kelly, do do
265 10 pieces Checks. W. & J. Watt, do do
266 Lot Fancy Soaps. L. Frank, do do
267 do India Rubber Silk. Webster & Leberman, do do
268 Card Press. E. A. Grattan, do do
269 Invoice Silver Plated Ware. Hatting, Myer & Warne, Phila. makers.
270 Case Cotton Linings. J. Monroe & Co., New York. T. R. Gill.
271 Porcelain Vase. Keller & Bright, Philadelphia, makers.
272 Diaphragm. do do do
273 1 piece Worsted Embroidery. Miss C. E. Van Horn, Phila., maker.
274 2 pieces Inlaid Wood. C. Volkers, New York, Burdfield & Ramson.
275 1 Case Carmine Ink. W. C. Bakes, Philadelphia, W. C. Bakes.
276 1 do Horticultural Implements. Paschall, Morris & Co. do.
277 Lot Ambrotypes and Mezzographs. I. Rehn, Philadelphia, maker.
278 do Manufactured Designs. School of Design for Women, Philadelphia, maker.
279 Case Artificial Teeth and Corrondom Wheels. Owen & Armstrong, Philadelphia, makers.
280 Dental Furnace. A. Marshall, Delaware, maker.
281 Lot Hair Paintings and Jewelry. Mrs. Reese, Philad., maker.
282 Drawing, Locomotive. Edward Page, do do
283 Case Steel Punches. Jacobus & Schell, do do

284 Lot Perfumery and Bitters. G. J. Nichols, Phila. Maker.
285 do Furniture Polish. Joel Fales, do do
286 Liquid Cleansing Cloth. do do do
287 12 pieces Flannels. Ballard Vale Co., Mass. Farnum, Kirkham & Co.
288 Case Wax Flowers. Miss Cady, Philadelphia, maker.
289 Case Ambrotypes and Russia Iron. J. R. Clemons, Philad. maker.
290 Lot Calamine Zinc Ore. Pennsylvania and Lehigh Zinc Company. Gordon Monges.
291 Case Ladies' Shoe Lasts. S. S. Redofer, Germantown, maker.
292 Lot Bed Hangings. Caroline Cantrell, Philadelphia, do
293 do Children's Embroideries. Mrs. E. Keyser, do do
294 do Ornamental Glass. Cooper & Belcher, New York. R. Shoemaker & Co.
295 6 Eyelet Machines. H. L. Lipman, Philadelphia, maker.
296 2 Valises and 1 Trunk. T. Mattson, do do
297 2 Boxes Starch. J. G. Gilbert, New York. A. B. Ives.
298 Invoice Ladies' Under-Garments, etc. Mrs. M. W. Ernest, Philadelphia, maker.
299 Lot Paints and Colours. Gilsboro Works, Camden, N. J. J. Lucas & Co.
300 32 Silk Umbrellas. W. A. Drown, Philadelphia, maker.
301 Sewing and Stitching Machine. Wheeler & Wilson's Manufacturing Company, Connecticut. H. Coy.
302 Lot Glassware. John Capewell, Philadelphia, maker.
303 5½ doz. Morocco Leather. G. Adler, do do
304 1 doz. Curaçoa Bronze Kid. Jos. Neville, Philadelphia, maker.
305 1 Case Artificial Legs. B. F. Palmer, do do
306 1 Model Cottage. W. R. Tiers, do do
307 4 Ladies' Skirts. J. M'Mullen, do do
308 Case Artificial Teeth. W. C. Eastlack, do do
309 do Masonic Jewels, etc. G. P. Pilling, do do
310 do Bibles. J. B. Perry, do do
311 Box Pin Type for the Blind. J. E. Carpenter, do do
312 Case Restraining Apparatus for Insane. J. S. Fisher, Philad. maker.
313 Fancy Acorn Basket. Miss Haines, do do
314 Case Artificial Flowers. R. Oehlschager, do do
315 Lot Stained Glass. R. W. Roberts, do do
316 4 pieces Tufted Talma Cloth. Bridgeport Woollen Mills. J. C. Howe & Co.
317 Frame Specimen Printing. H. A. Brown, Philadelphia, maker.
318 Silver Centre Piece. Taylor & Laurie, do do
319 Dressing Case, Writing Desk, etc. W. T. Fry. do do
320 Case Fancy Furs, etc. L. Fishblatt, do do
321 Lot Planes. B. Sheneman, do do
322 Case Mathematical Instruments. C. A. Saxe, do do
323 Model Bill Counter. C. C. M'Glathry, do do
324 3 Patent Measuring Funnels. A. C. Draud, do do
325 3 Cases Surgical Bandages. B. C. Everett, Phila. Maker.
326 Lot Leather. M'Neely, Siner & Wallace, " "

327 Lot Clothing Pins. Thomas W. Williams, Phila.
328 Patent Spring Shell Horse Shoe. Newbold, Safford & Co., Phila. Makers.
329 Tower's Patent Creepers. Safford & Williams, Phila. Makers.
330 Patent Self-supporting Scaffold. A. C. Funston, Phila. Maker.
331 Case Mathematical Instruments. J. R. Harbeson, " "
332 Case Wool. Coates & Brown, " "
333 Piano Forte. W. P. Emerson. Boston, A. P. Hughes.
334 3 Melodeons. Conhard Needham & Co., " "
335 Lot Earthenware, Granite and China. Taylor, Speeler & Bloor, Trenton, N. J. J. L. Hoffman.
336 Case Philosophical Instruments. M'Allister & Bro., Phila. Makers.
337 1 Lot Bronze. Leconte, jr., Phila. Maker.
338 Case Spices, &c. J. W. Lathrop, Phila. Maker.
339 Lot Sheepskin Bindings. Wm. Adams, Phila. Maker.
340 1 pair Water Proof Boots. J. J. Halsall, " "
341 1 Roach Trap. T. J. Berry, " "
342 1 Lot Alamandine. A. W. Galey, " "
343 5 Small Drawings. Isabella Hillen, " "
344 Piano Forte. B. Freeman, " "
345 Medallion. A. H. Briscoe, " "
346 3 Cases Silver Plated Ware. J. O. Mead & Son, Phila. Makers.
347 1 Case Embossed Veneers, 1 Table. Israel Amies, " "
348 Cast Steel Shears. Clarenback & Hedder, " "
349 Case Mathematical Instruments. Amsler & Weltz, " "
350 Piano Forte. Lane & Cairl, Phila. J. F. Wilkin.
351 Case Wax Fruit, &c. A. Lea, Phila. Maker.
352 Case Ladies' Children's Linen. Mad. Segorii, Phila. Maker.
353 " Dressing Gowns, Wrappers. " " "
354 Card Machine Shirt Bosoms. H. Coy, " "
355 Case Needle Work. Mrs. G. S. Miller, " "
356 Gilt Oval Mirror and Flower Stand. Newland & Co., Phila. Makers.
357 Case Masonic Marks. A. C. Supplee, " "
358 Frame Paper Stamp and Cutter. Marine Moore, " "
359 Case Straw Goods. T. White & Co., " "
360 " Fancy Bonnets. " " " "
361 Lot Gelatine Isinglass. H. Gerker, Son & Co., " "
362 Lot Sheep Skin Binding. J. H. Hummell, " "
363 Lot Needle Work. Mrs. Culp, " "
364 Glass Syringes and Bottles. Thos. Burns & Co., " "
365 West Patent Galvanic Cement Roofing. W. R. & D. S. Cornell, Phila. Makers.
366 Lot Gold Embroidery. Cuadnuv & Jeannett, Phila. Makers.
367 Lot Tin Japanned Ware. I. S. Williams, " "
368 2 Carved Gilt Looking Glass Frames. A. S. Robinson, Phila. Maker.
369 Small Carved Frames. J. Staley, " "
370 Bright Japanned Ware, Fancy Ware. Hadden, Carl & Porter, Phila. Makers.
371 Lot Window Curtain Fixtures. G. Lyman Miller, Phila. Maker.

372 Military Spur. J. S. Ewbank, Washington, D. C. Maker.
373 Violin. J. Albert, Phila. Maker.
374 3 Panoramic Business Directory. Baxter & Neff, Phila. Makers.
375 1 Case Shirts and Drawers. Newark Hosiery Co., Newark, N. J. W. E. Lockwood.
376 1 " Patent Enamelled Shirt Collars. B. H. Valentine & Co., N. Y. W. E. Lockwood.
377 1 Munson's Patent Lightning Rod. Dr. Darrah. Munson, Maker.
378 2 Pairs Skates. Bushnell & Tull. W. Vankook. Maker.
379 1 Leather Work basket, Wax flowers, &c. Miss Chapman, Phila.
380 1 Water Coloured Painting. Miss Smith, Phila.
381 1 Lot Perfumery. R. S. Cresfiani, Phila.
382 1 Lot Daguerreotypes and Ambrotypes. C. M. Ising, Phila.
383 1 Case Brimstone and Virgin Rock. Fred. Schlos, N. Y. M. Gulager & Bro., Phila.
384 2 Jars Saltpetre. C. & C. C. Henshaw & Co., Phila.
385 1 Canister Ox Cobalt. Buck, Simonin & Co. Makers.
386 3 Boxes Metallic Nickel. " " " "
387 1 Set Plated Coach Harness. M. M'Gee & Co. "
388 1 Case Cart Harness and Saddles. " " "
389 1 Bead Locomotive, &c. N. B. Kneass, Jr. N. B. Kneass.
390 1 Pastil Painting. Miss F. Chapman. Maker.
391 Papier Mache Pannel. D. D. Dick. "
392 1 Case Porcelain Teeth. Jones, White & M'Curdy. Makers.
393 1 Lot Wooden Soled Shoes. M. & J. Robinson. "
394 1 Case Machinist Tools. J. B. Brown & Sharp, Providence, R. I. W. W. Moore & Co.
395 1 Flute & Violin. John Pfaff, Phila. Maker.
396 1 Case Philosophical Instruments. L. C. Francis, Phila. Maker.
397 1 Case Prints. Manchester Print Works, N. H. J. C. Howe & Co.
398 2 Piano Fortes. Hunt & Co , Phila. Makers.
399 1 Case Harness. W. U. Moyer, Phila. Maker.
400 1 Case Weller's prime Blacking and Stove Polish. M. Curry. Maker, Phila.
401 1 Show Case. G. F. Kolb. Maker, Phila.
402 1 Lot Clothing. Jos. M. Bennett. Maker, Phila.
403 1 pair Gold Window Shades. A. H. Terhune. Maker, Phila.
404 1 Gilt Mercury. Edward Duferene. Maker, Phila.
405 1 Ornamental Frame. Mooney & Co. Makers, Phila.
406 1 piece Framed Needle Work. Mooney & Co. Makers, Phila.
407 1 Picture Frame. Geo. Wilson. Maker, Phila.
408 1 Telegraphic Instrument. J. J. Clark. Maker, Phila.
409 2 Sewing Machines. Hunt & Webster, Boston. Maker, J. Wilcox.
410 Lot Self-Sealing Cans. Wells & Provost, N. Y. " "
411 1 Dozen Rotary Knife Cleaners. J. Wilcox. " "
412 Lot Demerest's Magic Miniature Cook Stoves. Demerest, New York. Maker, J. Wilcox.
413 2 Rotary Gas Smoothing Irons. J. Wilcox. Maker, J. Wilcox.
414 1 Case Blank Books. W. F. Murphy. " "

415 1 Case Letter and Note Paper. W. F. Murphy. Maker, Phila.
416 1 " Doll Bodies. Miss M. Sturges. " "
417 1 " Accordeons. A. Faas. " "
418 1 Lot Curry-Combs. W. Beach. " "
419 1 Case Hair Jewelry. C. Staberrauch. " "
420 1 Lot Square Bake-pans. W. Beach. " "
421 1 Meat Maule. " " "
422 1 Case Bread. Chas. Wood. " "
423 1 " Carpenters' Tools. Booth & Mills. " "
424 1 Oil Painting. Vandenkerchhove. " "
425 1 Lot Patent Frame School Slates. E. Young & Co., Phila. P. F. Justice & Co.
426 3 Crochet Collars. Miss M. A. Matlack, N. J., Maker.
427 Picture of Washington. G. W. Wells. Phila., F. Bowers, Jr.
428 Case Pocket Books, &c. F. H. Smith, " Maker.
429 1 Jar Pickles. A. Hansell, " "
430 1 Invoice Umbrellas and Canes. W. H. Richardson, Phila. Maker.
431 1 Lot Chemicals. Powers & Weightman, Phila., Makers.
432 1 Lot Alum and Blue Vitriol. Powers & Weightman, Phila. Makers.
433 1 Lot Magic Lotion and Cough Pills. Dr. Stevens, Phila. "
434 1 Invoice Silver Ware. W. Wilson & Son, Phila. Makers.
435 1 Piano Forte. Hallett, Davis & Co., Boston. J. E. Gould.
436 4 Piano Fortes. Raven, Bacon & Co. N. Y., "
437 1 " Nunns & Clark. " "
438 1 Organ Harmonium. Mason & Hamlin, Boston. "
439 1 " " with Pedals. Mason & Hamlin, Boston. J. E. Gould.
440 3 Melodeons. Mason & Hamlin, Boston. J. E. Gould.
441 3 Kidder's Patent Gas Regulators. N. Y., Gas Reg. Co. New York, J. Wilcox.
442 1 Dry Gas Meter. Downs. New York, J. Wilcox.
443 1 Oil Painting. E. G. Andrews, Phila. Maker.
444 6 Photographs on Glass. F. Langenheim, Phila. Maker.
445 1 Quilt. Harriet L. Savage, Phila. Maker.
446 1 Case Millinery. E. Elsburgh, Phila. Maker.
447 1 Large Ornamental Gilt Frame. J. S. Earle, Phila. Maker.
448 1 Lot Daguerreotypes. Richards & Betts. " "
449 1 Lot Photographs. " " " "
450 1 Lot Portrait on Glass. " " " "
451 1 Case Artificial Teeth. Dr. I. Lukens, " "
452 1 Money Drawer. Richard Tea, " "
453 1 Case Patent Medicines. J. A. de Lute, " "
454 1 Lot Plated Ware. Hall & Boardman, " "
455 1 Lot Ornamental Gilt Frames. G. P. & J. E. M'Lean, Phila. Makers.
456 1 Case Dentistry. R. A. Porter, Phila. Maker.
457 1 Lot Saddlery and Harness. Lacey & Phillips, Phila. Makers.
458 4 Sides Harness Leather. Armstrong Crawford, " "
459 1 Lot Wax Splits. " " " "
460 1 Lot Printed Books. Dunsford & Freymouth, " "

461 1 Case Wigs and Perfumery. R. Dollard, Phila. Maker.
462 1 Piano Forte. Birgfield Ramm, " "
463 1 Square Piano Forte. " " "
464 1 Upright " " " " "
466 1 Frame Stone-Cutter's Bore Drill. F. Van Gunden, Phila. Maker.
467 1 Foot Stool. W. S. Nelson, Phila. Maker.
468 1 Case Ladies' Fine Shoes. J. W. M'Curdy & Son, Phila. Makers.
469 1 Case Elastic Garters. Eliza Drew, Phila. Maker.
470 1 Case Musical Instruments. Joseph Neff, Phila. Maker.
471 1 Crochet Cradle Counterpane. Mrs. M. F. Brooks, Phila. Maker.
472 1 Invoice Silver Plated Ware. E. W. Carryle, " "
473 1 " " " Jarvis & Cormerais, Boston. E. W. Carryle.
474 1 Invoiced Japanned Goods. E. Carter & Co., N. Y., E. W. Carryle.
475 1 " " " Taylor Hodges, " "
476 1 " " " Musgrove & Young, "
477 1 Invoice Table Cutlery. Lamson, Goodnow & Co., N. Y., "
478 1 Crochet Covering. Mrs. Wright, Phila. E. W. Carryle.
479 1 Lot Clothing. G. Stokes, Phila. Maker.
480 1 Graphite or Plumbago. S. Newell, Phila. H. D. Knight.
481 1 Case Gents' Furnishing Goods. Oldenburgh & Taggert, Philada. Makers.
482 1 Crochet Bed Drapery. Mrs. Taylor, Phila. Maker.
483 1 " Stand Cover and Tidy. Mrs. Newell, Phila. Maker.
484 1 Quilt and Patchwork Spread. Mary King, " "
485 1 Model Cottage. Jas. H. Snyder, " "
486 1 Collins' Improved Oil Test. Collins, Phila. C. W. Knight.
487 1 Over Coat and Pants. Oliver & Wells, Phila. Makers.
488 1 Lot Books. J. W. Moore, " "
489 1 Case Leather Flowers. A. Williamson, " "
490 1 Car Seat. M'Laran & Busher, " "
491 1 Lot Daguerreotypes and Ambrotypes. M. S. Hagaman, Phila. Maker.
492 1 " " Photographs. W. L. Germon, " "
493 1 Case Water Colours. G. W. Osborn & Co. " "
494 1 Case Philosophical Instruments. W. C. & J. Neff, " "
495 1 Frontispiece, U. S. Hose Co. A. E. Warner, Baltimore. H. J. Gallagher.
496 2 Model Hose Carriages. J. L. Fox, Phila. Maker.
497 1 Lot Blank Books. D. M. Hogan, " "
498 1 Lot Machine Stitching. Mrs. Egbert, "
499 1 Lot Root's System Writing. D. F. Lawrence, Phila. Maker.
500 1 Cornet Silvered. T. J. Weygandt, " "
501 1 Invoice Planes. John Colton, " "
502 1 Invoice Engraved Portraits on Steel. J. M. Wilson, Phila. Maker.
503 1 Case Hand Saws, Squares, &c. W. Cresson, Phila. Maker.
504 4 Mill and Cross-Cut Saws. " " "
505 1 Case Edge Tools. C. Hammond, " "
506 2 Cases Draw Knives, Chisels, &c. Whitman & Mills, Mass. Makers.
507 1 Card Patent Bitts. Caldwell & Ghriskey, Phila. Makers.

508 1 Lot Stained Glass. J. & G. H. Gibson, Phila. Makers.
509 6 Saw Mandrils. J. Whitney, Winchester, Mass. W. Cresson.
510 1 Invoice Safety Implements. P. S. C., Phila. Makers.
511 1 Acanthus Flower. T. Heath, " "
512 1 Malogramatic Drawing. M. S. Worrell, " "
513 1 Painting Flying Cloud. W. B. Bonfield, Beverly, N. J. S. H. Kirk.
514 1 Piano Forte. E. P. Graham, Phila. Maker.
515 1 Case Shuttles. E. Jackson, " "
516 2 Valise Trunks. A. T. Hickey, " "
517 1 Model Hose Carriage. F. Culberson, Phila. D. F. Linn.
518 1 Lot Writing Ink. B. Bussier, Phila. Maker.
519 1 Heat Box. W. Topfer, " "
520 1 Lot Needlework. Miss Peirce, " "
521 1 Water Colour Drawing. J. H. Dale, Phila. Maker.
522 1 Model Punching Machine. B. Martin, Phila. Maker.
523 1 Lot Books. W. H. Manrice, " "
524 1 " Steel Pens. Am. Steel Pen Manuf. Co., N. Y. A. Granger.
525 1 Case Children's Clothing. Mrs. H. G. Supplee, Phila. Maker.
526 1 Lot School Apparatus. Holbrook School Manuf. Co., Hartford. J. W. Queen.
527 1 Lot Air Pumps for Colleges. E. S. Ritchie, Boston. J. W. Queen.
528 1 Tierce Instruments and apparatus. "
529 1 Magno-Electro Machine. Dr. S. B. Smith, N. Y. Dr. W. H. Hazard.
530 2 Gyroscopes. W. B. Jones, Phila. Maker.
531 1 Frame Fancy Printing. E. Ketterlinus & Co., Phila. Makers.
532 3 Manifold Letter Writers. A. L. Adams, " "
533 Municipal & R. R. Telegraph. Phillips & Robinson, Phila. Makers.
534 2 Patent Book Cases. A. L. Adams, Phila. Maker.
535 1 " Steam Valve. R. Cornelius, " Cornelius & Baker.
536 1 Case Ladies' and Children's furnishing Goods. Miss M. L. Spooner, Phila. Maker.
537 1 Electro-Magnetic Machine. Dr. Dickinson, Phila. Maker.
538 1 Frame Hair Work. S. E. Albrick, Phila. Maker.
539 1 Lot Daguerreotype Bibles. Perry & Erety, Phila. Makers.
540 1 Electro-Machine. E. J. Ritchie, Boston. J. W. Queen.
541 3 Saddles. E. P. Moyer, Philadelphia. Maker.
542 1 Case Files. Lyman & Bunting.
543 1 Lot Squares and Trammels. P. Ferrault, Newark, N. J. Do.
544 2 Shovels. Antrim Shovel Co., Antrim. Do.
545 1 Water Closet. E. Bookens, Newark. Do.
546 1 Case Stair Rods. Eddy & Hinchman, N. Y. Do.
547 2 Jars white and coloured Vinegar. E. Jones, Phila. Maker.
548 1 Lot Patent Creased Traces. Hood, Milton, Pa. F. B. Myerley.
549 1 Gilt Frame and Charter. J. Vogdes, Phila. Maker.
550 1 Crochet Work Box. Miss Murdoch, Phila. Do.
551 2 Frames Flowers. Mrs. Sturdevant, Phila. Maker.
552 2 Pairs of Shoes. W. C. Weaver, " "
553 2 Reflecting Lamps. Jno. G. Smith, " "
554 Card Brass Work. Thos. Dodameade, Camden, N. J. Maker.

555 Model Tackle Scale. A. B. Davis & Co., Phila. Makers.
556 11 Spirit Plumb and Levels. Wm. Goldsmith, Phila. Maker.
557 Self-Acting Rail Road Telegraph. H. Seelhorst, inventor, Phila. Maker.
558 Vase Flowers, &c. The Misses Jones, Phila. Makers.
559 Drawing. Jno. B. Woods, Philada. Maker.
560 Lot Furnishing Goods. J. Burr Moore, Phila. Maker.
561 Counterpane. Mrs. A. Broom, Phila. Maker.
562 Case Surgical Instruments. J. H. Gemrick, Phila. Maker.
563 Flower Stand. L. Little, Phila. Maker.
564 Case Birds. G. Boudwin, " "
565 Case Musical Instruments. C. M. Zimmerman, Phila. Maker.
566 Drawing. Samuel T. Longstreth, Phila. Maker.
567 Lot of Handles. P. G. Reading, Frenchtown, N.J. J. E. Armour.
568 Basket of Fancy Flowers. Miss M. Frambus, Phila. Maker.
570 Drawing in Frame. Robt. K. Lovett, Phila. Maker.
571 " " J. M. Schoeffield, " "
572 3 Guitars. J. Bewind, Phila. Maker.
573 Lot of Coffee, &c. Bohler & Thompson, Phila. Makers.
574 Stool Covers. Miss E. Jones, Phila. Maker.
575 2 Embroidered Ottoman Seats. Miss C. M. Ackerman, Phila. Enos Baldwin.
576 Bed Quilt. Mrs. M. Smith, Phila. Maker.
577 2 Bed Quilts. Sarah M. Griffith, Phila. A. M'Donald.
578 2 Pictures and Frames. M. F. Adams, Phila. C. H. Adams.
579 Spirit Level. L. Brooks, Great Falls, N. H. L. E. Slow.
580 Extension Bit. A. Weeks, Boston. T. Smith.
581 Self-Inking Hand Stamp. Boston Hand Stamp Co., Boston. D. Ramsey.
582 Window Pane. D. R. Hudson, Boston. Maker.
583 Drawing and Frame. R. W. Roake, Phila. Maker.
584 2 Trunks. A. L. Hickey & Sons, Phila. Makers.
585 Pine Brew's Basket. Geo. Blyand, Phila. "
586 Lot Plaster Ornaments. W. H. French, Phila. Maker.
587 2 Pattern Trigger Protection Guns. B. H. Westerhood, Phila. Maker.
588 3 Coloured Drawings. A. Kollner, Phila. Maker.
589 3 Painted " M. B. Adams, Phila. E. L. Wilson.
590 Cape May Diamond Cottage. Mrs. R. Eams, Phila. Maker.
591 2 Frames, Spec. of Printing. Sturdivant & Maas, Phila. Makers.
592 Case Guns and Rifles. John Krider, Phila. Maker.
593 Lot Plaster Ornaments. A. Campbell, " "
594 Crayon Drawings. John H. Weeks, " "
595 Ornamental Signs. H. & N. Williams & Co., Phila. Makers.
596 Jobs Sears Stand. Mrs. R. Eams, Phila. Maker.
597 Bottle Patent Alcohol. Z. Locke & Co., Phila. Makers.
598 Crayon and Frame. Jas. Mackie, Phila. Maker.
599 Star Quilt. E. Reinert, Phila. Maker.
600 3 Infallible Locks. L. Yale, Jr., & Co., Phila. Makers.
Burglar Proof Safe. " " "

601 Lot Machinery Carved Block Letters. W. C. Murphy, Phil. Maker.
602 Pencil Drawing. W. Ettenger, Phila. Maker.
603 Case Mathematical Instruments. S. Morset, Phila. Maker.
604 7 Pieces Cassimeres. Amer Mills Co., Rockville, Conn. Hacker, Lea, & Co.
605 2 Bottles Glass Makers' Sand. R. Wittecar, Phila. Maker.
606 Lot Plaster Images. H. Maguire & F. Gossin, " "
607 Turk's Head. H. Wilkins, Phila. Maker.
608 Patent Self-Priming Gun Lock. J. S. Butterfield, Phila. Maker.
609 Card Pearl Buttons and Studs. Mustin & Bennet, " "
610 Case Artificial Teeth. C. Patterson, Phila. Maker.
611 Machine Drawing. Muntzinger, " "
612 Frame Specimen Marble Paper. Chas. Williams, Phila. Maker.
613 Case Gent's. Furnishing Goods. Miss H. Souder, " "
614 3 Pairs Ladies' High Boots. J. T. Warren, Philada., Maker.
615 Case Carriage Bolts. T. and W. Shields, Phila. Makers.
616 3 Frames Chromo-Lithograph. L. N. Rosenthal, Phila. Maker.
617 Small Model Fire Engine. R. Stileman, Jr., " "
618 Card Razors. W. Gilchrist, Phila. Maker.
619 Case Oil Silks, Assorted. S. Wright & Son, Phila. Makers.
620 2 6 Lt. Chandeliers, "Armor" Bronze, Cornelius & Baker, Phi. Mkr's.
621 1 12 do "Maritime" Gilt, do do
622 2 6 do "Chinese" Artistic, do do
623 2 6 do "Rococo" Gilt, do do
624 2 6 do "Louis XIV.," Verd Antiq., do do
625 1 6 do "Jacobin," Bronze, do do
626 2 3 do "Science Trimming Lamp of Life," do do
627 1 8 do "Rennaissance," Relieved, do do
628 2 6 do "Greek," Bronze, do do
629 2 3 do "Flying Cupid," Gilt, do do
630 1 3 do "Dancing Figure," Gilt, do do
631 1 6 do "Warrior," Bronze, do do
632 2 3 do "Library," Artistic, do do
633 1 3 do "Griffin," Bronze, do do
634 2 6 do "Franklin," Artistic, do do
635 2 6 do "Western Hunter," Vd. Ant. do do
636 1 3 do "Highlander," Bronze, do do
637 1 1 Lt. Pendant, "Bacchus," " do do
638 1 1 do "Hunting," Artistic, do do
639 1 1 do "Terminal," Bronze, do do
640 2 1 do "Egyptian," Verd Antiq., do do
641 2 3 Lt. Brackets, "Eagle," Gilt, do do
642 2 1 do "Highlander," Gilt, do do
643 2 1 do "Griffin," Gilt, do do
644 2 2 do "Science and Prud.," Gilt, do do
645 2 2 do "Barge of Cleopatra," do do do
646 2 2 do "Laughing Satyr," Bronze, do do
2

647 2 2 Lt. Brackets, "Castellated," Bronze, Cornelius & Baker, Phila. Makers.
648 2 1 Lt. Pillars, "Mercury," Bronze, do do
649 2 Reading Lights, "Tamborine," Bronze, do do
650 2 do "Brigand," Bronze, do do
651 2 do "Franklin," Bronze, do do
652 2 do "Washington" Bronze, do do
653 2 Reading Lights, "Water Carrier" Bronze, do do
654 2 do "Knight" Bronze, do do
655 2 do "Hunter" Bronze, do do
656 2 Segar Lighters, "Old Man," Bronze, do do
657 2 Bronze Statues, "Zouave & Highlander," do do
658 2 do "Mercury," do do
659 2 do "Buffalo," do do
660 2 do "Stag," do do
661 2 do "Globe and Books," do do
662 14 Sets Girandoles "Asso. patt. Gilt and Silver," do do
663 8 pr. 3 lt. do do do do do do
664 40 Solar Lamps do do Bronze," do do
665 2 Regulator Clocks, duplex movement. Heitel & Bro., Phila. Makers.
666 1 Stand Drugs and Chemicals. C. Ellis & Co., Phila. Makers.
667 Patent Clutch Pulley. Wendell & Wright, N. Y. Lyman & Bunting.
668 3 Patent Horse Shoes. N. B. Carpenter, do do do
669 Pat. Apple and Peach Machine. S. Coleman & Co., N. Y. Lyman & Bunting.
670 2 Bench Rests. Chandler & Gray, Salem, Mass. Lyman & Bunting.
671 Pat. Bench Hook. Clapp & Nuttall, Wappington Falls, N.Y. do
672 2 Pat. Box Openers. G. C. Taft, Worcester, Mass. Lyman & Bunting.
673 2 Seal Presses. E. Kallenberg & Co., Phila. Makers.
674 2 Maps U. S., and Penna. Maps. R. L. Barnes, Phila. Maker.
675 Lot Stone and Earthenware Enamelled. Henry Remmy, Phila. Maker.
676 Case Cigars. F. Hafner, Phila. Maker.
677 Case Dry Goods. Hamilton Woollen Co., Southbridge, Mass. Lafourcade, Cox & Co.
678 Lot Machine Sewing Silk. Gurney & Co., New York. Chas Lang.
679 Bed Quilt. Mary E. Craw, Phila. Maker.
680 Case Gold and Silver Surgical Instruments. J. S. Warner, Phila., Maker.
681 2 Cases Optical Instruments. J. Schnaitman, Phila. Maker.
682 Case Porte Monnaies and Fancy Goods. C. Rumpp & Co., Phila. Makers.
683 Lot Needle Work. Anna E. M. Smith, Phila. Maker.
684 Bed Quilt. Mrs. S. A. Fulton, Philadelphia. Maker.
685 Invoice Gas Regulators and Meter. Penna. Gas Reg. Co., Phila. Maker.
686 3 Pieces Black C. W. Cloths. J. M. Church & Bros., Middlefield, Mass. Dulles & Hewson.
687 Lot Marine Algæ. J. M. Somerville, Phila. Maker.
688 Lot Engraved Masonic Emblems. J. F. Leak, Phila. Maker.
689 Lot Tin and Japanned Ware. I. S. Williams, do do

690 4 Fly Brushes and 6 Fans. Mrs. Janney, Fallsington, Pa., maker.
691 Lot Silver Ware. Conrad Bard & Son, Philada. do
692 2 Portable Extempore Cook Gas Operators. Chas. Parham, Phila. Maker.
693 Portrait Henry Clay. C. Youngler Haynes, Phila. Maker.
694 4 Samples Oil Cloth. J. S. Depuy & Son, do do
695 Carpet Stretcher. W. E. Vanderford, do do
696 Patent Piston. Touchstone & Clark, do J. H. Clark.
697 Case Books. S. F. Kerns, Phila. Maker.
698 Crayon Drawing. A. W. Janvier, Phila. S. M. Palmer.
699 Gilt Frame. J. S. Earle, do Diligent Engine Co.
700 Patent Melanotype Plate. Jas. Cremer, Phila. Maker.
701 Lot Planes. D. Colton, do do
702 Large Bird Cage. E. Mosemann, do do
703 Design Steeple Engine, U. S. Mint. J. Smith, Jr., Phila. Maker.
704 Fancy Embossed Frame. Miss E. Johnson, do do
705 Case Furniture Polish. Stephen Davis, do do
706 Fancy Picture. Miss C. Johnson, do do
707 Map of the World. R. L. Barnes, do do
708 Oriental Painting. Mrs. E. A. Hankins, do do
709 Card Patent White-Wash Brushes. E. Clifton, do do
710 2 Chair Covers Embroidered. Miss E. Johnson, do do
711 Bronze Frame. A. H. Powell, do do
712 Case Newall's Portraits. R. Newall & Co., do do
713 Vase Wax Flowers. Miss Cady, Philadelphia, maker.
714 Piano Forte. Neill, Duross & Co., Baltimore, do
715 Happy Uncle Tom's Shoe. Farley, Morrison & Co., Mass. Whelan & Co.
716 Masonic Frame. J. Cowpland, Philadelphia. J. C. Cowpland.
717 3 Frames Lithographic Checks, Notes and Bonds. William Mann, 34 So. 3d St., Philadelphia, maker.
718 2 Plume Mirror Fly Brushes. J. Wilt, Philadelphia, maker.
719 Ivory Image and Case. Harvey Ford, do do
720 2 Frames Sewing Machine Embroidery. Miss H. Tupman, California. W. De Young.
721 Bed Quilt, Odd Fellows' Delight. Mrs. C. Wheeler, Philad., maker.
722 2 Specimens Quilting. A. C. Bryson, do do
723 Lot Needlework. Mrs. Heiler, do do
724 Pair Epaulettes. H. Korn, do do
725 Case Ladies' Wrappers, etc. Mrs. L. Spooner, do do
726 Shell Work Box. Mrs. E. Levy, do do
727 3 Piano Fortes. T. Gilbert & Co., Boston. D. H. Shirley.
728 1 Model Piano Forte Action. D. H. Shirley, Boston, maker.
729 Portrait Dr. Jayne. E. D. Marchant, Philadelphia.
730 do S. K. Hoxie. do do
731 Case Fife's Oblique Gold Pens. Jones & Morgan, Phila.
732 Patent Egg Beater. Reip & Collier, Baltimore. G. H. Metz.
733 Specimen Ornamental Frame. J. S. Earle, Philadelphia. America Hose Company.

734 Specimen Copper, Silver and Lead Ore. Phila. R. O'Neill.
735 do Parchment Paper. J. M. Willcox & Sons, Philad., makers.
736 3 Samples Lubricating Oil. Martin Drake, New York. J. P. Martin.
737 Portable Gas Lamp. Dr. Englebrecht & Plant, do do
738 Conical Damper. Dr. Englebrecht & Nye, do do
739 Model Cottage. J. J. Levy, Philadelphia, maker.
740 Invoice Polishing Powder. Wm. Humphries, Savannah, Georgia.
741 2 Frames Card Writing. Mooney, Phila. B. B. Euston, Phila.
1101 1 Figure of a Friend. Mr. Fergus, West Chester. M. B. Thomas.
1102 1 Paging Machine. Doane & Co., N. Y. Makers.
1103 1 Patent Revolver. do do do
1104 1 Steam Register. do do do
1105 1 Bow Gun. E. Amsetta, Phila. M. Mershon.
1106 1 Model R. R. Break. P. Hibbs, Bucks Co. M. Mershon, Phil.
1107 1 Model Heater. J. Reilly, Phila. M. Mershon.
1108 1 Double Action Lift and Force Pump. W. C. & J. S. Burham, N. Y. W. L. Gilroy, Phila.
1109 3 Fancy Signs. G. B. Nichols, Phila. Maker.
1110 1 Faucet Fitter. S. C. Clark, Camden, N. J. Maker.
1111 1 Monochromatic Painting. Miss Gilroy, Phila. do
1112 1 Specimen Pipe Ore. C. B. Campbell & Co., do do
1113 1 Lot Wooden and Willow Ware, J. H. Allen & Co., Phila., Makers.
1114 1 Sample Broad Pruning Shears. H. A. Dreer, do
1115 1 Specimen Ivory Statuary. Harvey & Ford, Phila. Makers.
1116 2 Apple Parers. Sargent & Foster, Phila. W. S. Fletcher, Phila.
1117 1 Patent Sash Fastener. E. M'Clain, do. C. F. Fisk, Phila.
1118 1 Box Bricks. W. W. Smedley, Bridesburg. Maker.
1119 1 Breast Drill. C. B. Crossman, Phila. Maker.
1120 1 Pat. Harrow. Gourley Patent, Winchester, Va. G. P. Meteer, Philadelphia.
1121 1 Detachable Shaft Coupling. Peter Teal, Phila. Maker.
1122 1 Patent Air-Tight Hydrant and Wash Basin combined. J. L. Johnson, Maker.
1123 1 Rotary Pump. C. C. Alden, Phila. Maker.
1124 1 Lot Wrought Nuts. Brayton Wrought Iron Manufacturing Co., N. Y. Lyman & Bunting, Phila.
1125 6 Silvered Glass Curtain Pins. Silver Glass Co., N. Y. Lyman & Bunting, Phila.
1126 5 Vault Lights. G. R. Jackson & Co., N. Y. Lyman & Bunting, Phil.
1127 2 Seven Octave Pianos. W. Knabb & Co., Baltimore. Makers.
1128 1 Horse Collar Block. W. H. Bustin, Watertown, Mass. Maker.
1130 1 Frame Cantelope Seed Work. Miss Antonio, Phila. Maker.
1131 1 Square and Triangle. R. Newshan, Phila. W. H. Merrick, Phila.
1651 2 Hot Air Furnaces. S. M'Ferran, Philadelphia, maker.
1652 Ornamental Iron Bedstead. do do do
1653 Locomotive Head Light. D. D. Miller, New York. Pratt & Freeman, Philadelphia.
1654 2 Locomotive Head Lights. Radley & Hunter, do do
1655 1 do do do J. A. Williams, Utica, do

1656 1 Steam Pump Fire Engine. Taylor, Campbell & Co., Brooklyn. James E. Thorp, N. Y.
1657 1 Fire Board Stove. Morris & Co., 59 North Sixth Street, makers.
1658 1 Hot Air Cooking Range. do do do
1659 1 Bath Boiler. do do do
1660 1 Hot Air Furnace. A. H. Bartlett, N. Y. T. Murray, Seventh and Chestnut Streets.
1661 1 MacGregor's Heater. Chadwick & Brother, Philadelphia, makers.
1662 1 do Portable Heater. do do do
1663 1 do Dining Room Heater. Chadwick & Bro. Phila. do
1664 1 Dining Fire-Board Stove. do do do
1665 1 American Range. Bristow & Co., Providence. Chadwick & Bro., Philadelphia.
1666 1 Hayes' Ventilator. Chadwick & Bro. Philad. do
1667 1 Siddell's Self-Cleaning Furnace. J. Siddell, New York, maker.
1668 1 do Tubular Heater. do do Henry J. White.
1669 1 Hot Air Range. Henry J. White, Philada. do maker.
1670 1 Parlour Heater. J. Siddell, New York. do do
1671 1 Flat Iron Heater. Davey & Co., Troy, N. Y., do do
1672 1 Lumber Cart. R. B. Scott, Philadelphia, maker.
1673 1 Cart. do do do E. F. Scott.
1674 1 Jackson Patent Detachment Safety Cabin. W. R. Jackson, Baltimore, maker.
1675 1 Ryan's Self-Connecting and Detaching Car Couplings. Ryan & Griffin, Wilmington, Del., makers.
1676 1 Model Roof. H. M. Warner & Co., Philadelphia, makers.
1677 1 Hand Power Drilling Machine. R. Wilson, Milton, Pa., maker.
1678 Lot Fire Brick and Tile. Mueller & Newkumet, makers.
1679 1 Fire Hose Carriage. J. Young & Sons, Philadelphia, makers.
1680 1 Cedar Tub. J. Amos & Son, do do
1682 1 Patent Turning Lathe. J. H. Gould, do do
1683 2 Cook Stoves. A. Gleason, do do
1684 2 Gas Stoves. do do do
1685 1 Drug Mill. B. Swift, New York. J. G. Richardson.
1686 1 Safety Guide Railway. W. D. Bates, Philadelphia, maker.
1687 1 Model Apparatus for Steam Boilers. J. Fricke, do do
1688 1 Chronometer Engine, (Reed Patent.) Reed & Burbeck, Jersey City. W. B. Levan.
1689 1 Clark's Steam and Fire Regulator. A. Campbell, maker, N. York.
1690 1 Eddy's Scroll Chuck. E. Eddy, maker, New York. A. Campbell.
1691 1 Portable Four Horse Power Farm Engine. A. L. Archambault, Philadelphia, maker.
1692 1 Dove-Tail Mortising Machine. J. G. Baker & Co., Phila., makers.
1693 1 Coil Iron. C. E. Smith & Co., Philadelphia, makers.
1694 1 Last Machine. J. Russell. Garrett Vansant, Phila.
1695 1 Patent Brick Machine Model. Isaac Harman, Schuylkill County. H. Howson, Philadelphia.
1696 1 Rope Machine. Mower & Woodworth, Boston, makers.
1697 1 Twine do do do do

1698 2 Hand Brick Presses. Samuel P. Miller, Philadelphia, maker.
1699 1 Hand Brick Press. do do
1700 Invoice Iron Railing, Columns and Statuary. W. P. Hood, Phila. Maker.
1701 Iron Arbour. Garland & Story, Phila. Makers.
1702 Lot Stoves. North, Chase & North, Phila. B. Bardsley, Phila.
1703 1 Rockafellow's Combd. Mower and Reaper. Rockafellow & Howell, Phila. C. Bradfield, Phila.
1704 1 Pat. Child's Carriage. J. & C. Berrian, N. Y. J. H. Gould, Phila.
1705 1 Model Washing Machine. E. Lukens, Phila. Maker.
1706 Lot Scales. Fairbanks & Ewing, Phila. Makers.
1707 1 Model of a House. A. W. Haworth, Phila. Maker.
1708 1 Screw Cutter. Nelson Barrows, Phila. Maker.
1709 2 Fan Blowers (Alden's.) M. Alden, Phila. Maker.
1710 1 Wheel Side and Boxes. " "
1711 1 Concave Washing Machine. H. D. Cooper, Phila. Maker.
1712 3 Portable Ironing Tables. " " "
1713 2 Cochrane's Patent Hydrants,—non-wasting and non-freezing. W. L. Gilroy, Phila. See Advertisements, p. 13, for description.
1714 1 Model Brig. T. Davidson, Jr., Phila. Maker.
1715 1 Cedar Tank. G. J. Burkhardt & Co., Phila. Makers.
1716 1 Rail Road Car Ventilator. S. M'Clellan, " H. S. B. Lewis, Phila.
1717 1 Perkenpine's Axle Box. E. R. Perkenpine, Phila. Maker.
1718 3 Tin Milk Churns. Edward Evans, " "
1719 1 Model Sample Slating. Harford Manufacturing Co., Md. J. L. Taylor, Phila.
1720 1 Panel Vice. Yellow Spring Co., Ohio. Thompson & Babbit, Phila.
1721 Brick Machine Model. Jas. A. Hammer, Reading, Pa. Henry Kimber.
1722 1 Ward's Self-Acting Car Coupling. J. C. Ward, Phila. Maker.
1723 1 Model City Rail-Way. D. D. Badger & Co., N. Y. John A. Gendell, Phila.
1724 1 Washing and Drying Machine. H. N. Black, Phila. Black, Pearson & Taylor.
1725 1 Lyons' Lightning Rod. Lyons, Wilmington, Del. Chadwick & Bro. Phila.
1726 1 Bath Boiler. John Myers, Phila.
1727 1 Locomotive Model. W. Parrins, Phila. B. C. Street, Phila.
1728 1 Hoop-Splitting Machine. American Hoop Machine Co., Fitchburg, Mass. J. Phillips, Mass.
1729 1 do Shaving " " "
1730 1 Planetary Steam Engine. Kite & Co., Phila. J. Black, Mass.
1731 3 Ratchet Handle. G. H. Pallott, Boston. H. W. Lindelach, N. Y.
1732 3 Banister Washboard. H. C. Hatch, Stafford, N. H. J. H. Allen & Co.
1733 2 Transversed Corrugated Wash Boards. J. Kelch, Waterloo, N. York.
1734 1 Case Maker's Lathe. H. H. Smith, Philadelphia, maker.
1735 1 Jeweler's Rollers. do do do
1736 Lot Cottage Furniture. Courtney & Willets, do do

1737 1 Corn Planter. J. D. Jeffries, Phila. Maker.
1738 1 Stubblefield's Steam Gauge. Albertson & Douglass' Machine Company, New London. W. B. Le Van, Philadelphia.
1739 1 Schaffer's Steam Gauge. Harrison, N. Y. W. B. Le Van, Phila.
1740 A. Schmidt & Co.'s Steam Gauge. A. Schmidt & Co., New York. W. B. Le Van, Philadelphia.
1741 1 Improved Maximum Hand Gauge. Harrison, N. York. W. B. Le Van, Philadelphia.
1742 1 Improved Mercury Gauge. Wm. Gee, do do
1744 1 Pall or Rachet Wrench. W. B. Le Van, Phila. do
1745 1 Screw Cutter. Nelson Barrows, do do
1746 ½ Bbl. Buckwheat. Wilson Ager, Columbia. Lefevre, Black & Co. Philadelphia.
1747 3 Bbls. Flour. Union Mills, Columbia County. J. C. Stockton, Phila.
1748 1 Decoy. R. G. Wilkins, Philadelphia. E. P. Davis, do
1749 1 Yacht Model. Andrew Luffbary & Co., Phila. Makers, Pa.
1750 1 Skeleton Boat. " " "
1751 2 Sides Sole Leather. George S. Downing & Son, Wilmington, Del. Makers.
1752 Agricultural Implements. Charles Bradfield, Phila. Maker.
1753 Invoice Machines, &c. Stowe Manufacturing Co., Plantersville, Conn. N. Trotter & Co., Phila.
1754 1 Clover Seed Gatherer. Joshua Taylor, Phila. Maker.
1755 3 Bundles Brooms. S. G. & H. Moffitt, " "
1756 1 Model Farm Flour Mill. Rogers & Boyer, " "
1757 1 Farm Mill. " " "
1758 2 Gothic Corn Shellers. " " "
1759 1 Mowing Machine. " " "
1760 1 Spice Coffee Mill. Charles Shaw. " "
1761 1 Model Mowing Machine. A. Herman. Camden, "
1762 1 Model Yacht. Godfrey Krause, Phila. W. Y. Heberton, Phila.
1763 1 Locomotive Head Light. D. D. Miller, N. Y. Pratt & Freeman, Phila.
1764 1 Mercurial Steam Gauge. Hurford & Feast, Camden, O. " "
1765 Lot Brooms. Benj. H. Turner, Phila. Maker.
1766 Lot Brushes. " "
1767 1 Rocking Chair & Work Stand. Chas. Bosse, Phila. Maker.
1768 Lot Cedar Ware. L. M. Leyser, " "
1769 1 Improved Hydrant. C. J. Cowperthwaite, Phila. W. Cowperthwaite, Phila.
1770 1 Device preventing damage by water. Thos. Estlack, Phila. Maker.
1771 1 Wagner's Adjustable Reciprocating Saw. T. Mason, Phila. J. B. Imlay, Phila.
1772 1 Model Blower and Pumping Machine. J. P. Ross, Lewistown, Pa. Maker.
1773 1 Model Upright Engine. G. C. Hawkins, Phila. C. P. Hawkins, Phila.
1774 1 Silver's Marine Governor. T. W. Mason, Phila. Thos. Silver, Phila.
1775 1 Trotting Wagon. J. S. Collins & Son, Camden, N. J. Makers.
1776 1 Turned Centre Table and Fruit Dish. J. Hoover, Phila. Maker.
1777 1 Case Lasts for Stitching and Clamping Boot Trees. George Munro, Phila. Maker.
1778 1 Invoice Scales. Abbott & Co., Phila. Makers.

1779 Invoice Agricultural Implements. D. Landreth & Son, Phila. Makers.
1780 1 Pedestal Register. Tuttle & Baily, N. Y. Chadwick & Bro., Phila.
1781 1 Patent Street-Sweeping Machine. King & Dorsey, Phila. King & Hyneman, Phila.
1782 1 Barrel Flour. H. N. Black. Maker.
1783 1 Coal Sieve, with Supplementary Grate. B. F. Fœring, Phila. Maker.
1784 2 Bird Cages. S. Gunther, N. Y. J. Evans, Phila.
1785 1 Model Brick-Making Machine. C. Carnell, Phila. Maker.
1786 1 Revolving Oil Cup. J. D. Custer, Norristown. "
1787 2 Refrigerators. Murphy & Yarnall, Phila. "
1788 1 Tentering Machine. H. B. Fiske, Phila. W. H. Butterworth, Phil.
1789 Rotary and Reciprocating Pump. Cullingworth & Muldoon, Manayunk. J. J. Thomas, Manayunk.
1790 2 Models Patent Soap-Cutting Machine. Van Hagan & Co., Cincinnati, O., Makers.
1791 2 Models Improved Window Sash. C. S. Weaver, Phila. Maker.
1792 Bailey's Patent Lamp Burner. Y. Bailey, Phila. J. B. Imlay, Phila.
1793 1 Can and 4 Safety Lamps. S. E. Winslow, Phila. Maker.
1794 1 Ash Sifter. E. H. Deemer, " "
1795 1 Patent Casement Sash. G. M. Ramsey, N. Y. B. Cox, Phila.
1796 1 Model Brick Machine. N. B. Aiken, Phila. S. Ustick, Phila.
1797 1 Drill. L. B. Griffith, Phila. G. W. Anderson, Phila.
1798 1 Model Steam Engine. Mason, Phila. H. Matlack, Phila.
1799 Meat Cutter. L. B. Griffith. Maker.
1800 Model for Bridge. A. Catnach, Phila. Maker.
1801 Chill'd Tire Wheel. S. Morris, " "
1802 2 Spring Beds and Bolster. J. E. Cresson, Phila. Maker.
1803 Soap Stone Sink and Griddles. E. Pratt, Phila. Maker.
1804 Skiff Model. J. Cornell, Phila. W. Morrison, Phila.
1805 Reaction Pump. A. L. Archambault, Phila. W. B. Archambault, Phila.
1806 Child's Carriage. J. Ashenfelter, Phila. Wm. M'Carter, Phila.
1807 Model Brick Machine. J. Coltin, Phila. E. Wiltbank, Phila.
1808 1 Granite Lamb. Barker, Wright & Co., Makers.
1809 Model Rotary Card Press. F. P. Wallis, Phila. Maker.
1810 Omnibus Register. " " "
1811 4 Baskets. Fairbanks & Hill, Phila. J. H. Allen & Co., Phila. Makers.
1812 Lot Cedar Ware. E. Murdoch, Jun., Balt. " "
1813 Lot Corn Brooms. J. H. Allen & Co., Phila. Makers.
1814 2 Fire Proof Safes. Farrels & Herring, " "
1815 1 Paging Machine. R. S. Halls, Worcester, Mass. C. Williams, Phila.
1816 1 Smoke Pipe. H. B. Lyons, Phila. Maker.
1817 1 Bed Quilt. M. Early, Phila. W. H. Early, Phila.
1818 1 Low Top Buggy. Lane & Co., Phila. Makers.
1819 1 Case Morocco. J. H. Hummel, Phila. J. J. Sowers, Phila.
1820 Double Lift and Force Pump. W. H. Harrison, Phila. Maker.
1821 1 Chasing Lathe. R. Dolby, " "
1822 2 Seed Presses. E. Kalenberg & Co., " "
1823 1 Hydrant. A. J. Baker, Balt. Jas. Cochrane, Balt.
1824 1 Marble Chest Table Top. E. Young, Phila. Francis, Phila.
1825 1 Grindstone. J. E. Mitchell, Phila. Maker.

1826 Invoice Case Reeds. Beck & Doebely. Phila. Makers.
1827 Lot Adjustable Pullies. J. T. Sutton & Co., Phila. J. Trempers, Phila.
1828 1 Tennessee Marble Mantle and Table Top. E. K. Hess, Phila. M. W. Dickerson, Phila.
1829 1 Apple Cutting Machine. Larke & Milnor, Phila. J. B. Smith, Phila.
1830 6 Chairs. G. M. Carter, Phila. Maker.
1831 Improved Circular Saw. N. Barlow, N. Y. Maker.
1832 Model Marble Sewing Machine. J. Ashenfender, Phila. S. A. Salter.
1833 Hawkins' Universal Patent Chuck. E. Hawkins, Windsor Locks, Mass. A. Gavitt, Phila.
1834 Straw-Cutting Machine. W. Colliday, Phila. Maker.
1835 2 Bundles Leather. C. B. Williams, " "
1836 Improved Binding Machine. E. A. & C. Killburn, Burlington, Vt. C. Buckingham, Phila.
1837 1 Billiard Table. Stout & Burch, Phila. Makers.
1838 1 Fancy What-Not. John Henry, " "
1839 Bundle Shaved Harness. J. Boustead, Phila. Maker.
1840 Barrels Flour. Tennessee and Central Mills, Phila. Wright & Co.
1841 1 Self-Acting Fire Extinguisher. R. B. Armitage, Phila. Maker.
1842 Invoice Improved Carriage Fixtures. S. K. Chew, N. Y. Maker.
1843 Fire Escape Ladder. G. W. Keller, Phila. Maker.
1844 1 Hay Grain Rake and Seed Sower. Wrandall & Pratt, Phila. Makers.
1845 Ketcham's Mowing Machine. Howard & Co., Buffalo, N. Y. Paschall & Morris.
1846 6 Sides Shoe Skirting. W. Geyer, Phila. G. Williams.
1847 1 Globe Grain and Spice Mill. A. Attwood & Co., Troy, N. Y. A. K. Shriver.
1848 3 Steam Gauges. Alkraft & Whiteman, Phila. Makers.
1849 Liberty Steam Engine. J. M'Cay, " "
1850 Lot Furniture. G. J. Henkels, " "
1851 Office Desk. D. K. & S. D. Large, " "
1852 Apparatus for Distributing Water. A. Stone.
1853 4 Pieces Hemp Hose, and 6 pieces Flexible Tubing. A. Stone. Maker.
1854 1 Grass and Grain Cutter. W. W. Kerport, Salem, N. J. Maker.
1855 Gas Burner. Weymer & Bro., Phila. Makers.
1856 Corn Sheller. H. E. Smith, Phila. Maker.
1857 1 Scroll Saw. L. Wright, Newark, N. J. Maker.
1858 Improved Bench Plane and Iron. H. Harris, Newark, N. J. Maker.
1859 Rope Machine. T. G. Boone, Brooklyn, N. Y. Spear & Boone, N. Y.
1860 Window Frame. A. Spear, Passaic, N. J.
1861 3 Velocipedes. W. Queen, Phila. Maker.
1862 2 Rolls Hair Felting. H. W. Miller, Phila. Maker.
1863 Self-Loading Cart. Z. Butt, Lincolnton, N. C. H. Howson, Phila.
1864 Lightning Rod. A. C. Brown, Phila. Maker.
1865 4 Hydraulic Rams, &c. A. Gawthraup, Wilmington, Del. A. C. Brown.
1866 6 Brass Centre Pumps. Downs & Co., N. Y. A. C. Brown, Phila.
1867 Apple Paring Machine. Goodman, New Haven, Conn. "
1868 Improved Gas Pipe Tongs. S. Hardy, Phila. Bardsley.
1869 1 Dog Skin. A. Davison, Phila. G. Naulty.
1870 Patent Bedstead. Smith & Pugh, Phila. Makers.

1871 Patent Double Acting Ventilator. Geo. W. Thatcher, Phila. Maker.
1872 Stand Candle Moulds. J. Calverly, Phila. L. Calverly.
1873 Churning Machine. W. S. Reinerts, Phila. Maker.
1874 Dentists' Operating Chair. Kite & Kersey, Phila. Makers.
1875 Mower and Reaper. J. Manning, Phila. Maker.
1876 Lot Brooms. Chipman & White, Phila. Makers.
1877 Blooms' Patent Math. Lock. Blooms, Phila. C. Bradfield.
1878 Young America Feed Cutter. C. Bradfield, Phila. Maker.
1879 3½ dozen Sides Morocco. Samuel Buck, Phila. Maker.
1880 Gum and Leather Belting. White & Bro., N. Y. Billington & Emery.
1881 15 Child's Carriages. Bushnell & Tull, Phila. Makers.
1882 3 boxes Kindling Wood. Connover & Reanney, Phila. Makers.
1883 1 Wood-Planing Machine. Grey & Wood, Boston. J. M. Hollinghead, Phila.
1884 Tenoning Machine. J. A. Fey & Co., Worcester. J. M. Hollinghead, Phila.
1885 Brass finish Lathe. Bacon & Hubbitt, Boston. "
1886 Patent Cutting Machine. Cutting Machine Co., Boston. "
1887 Revolving Last Cutter. H. H. Green, Springfield. C. Clark.
1888 Iron-Planing Machine. Washburn & Withing, West Stafford, Conn. J. M. Hollinghead.
1889 J. P. Hays' Welcome Cooking & Heating Range. J. P. Hays, Phila. Maker.
1890 Self-Igniting Hydrogen Gas Apparatus. J. P. Hays.
1891 J. Wright's Patent Smoke House. J. Wright, Wilmington. John A. Griffin.
1892 2 Hot Air Furnaces. Marklee & Thatcher, N. Y. Peters & Johnson.
1893 2 " " Parlour Stoves. " " " "
1894 Invalid Chair. J. S. Scattergood, Phila. Maker.
1895 Fine Trunk. J. Unruh, Phila. Maker.
1896 Patent Printing Press. G. P. Gordon, N. Y. H. Evans, Phila.
1897 2 Dempfer's Patent Fan Blowers. S. Kisterbock & Son, Phila. Makers.
1898 Miniature Stove. B. F. Foering, Phila. Maker.
1899 5 Blinds. A. Britton & Co. " "
1900 Machine Brush. G. B. Eggleston. " "
1901 G. J. Naylor's Patent Scrub Brush. G. J. Naylor, Phila. Maker.
1902 Sole Dry Hard Leather. J. Hoffman, East Waterford. Pritchett, Baugh, & Co.
1903 Lot Galvanized Sheet and Rod Iron. M'Culloch & Co., Phila. Makers.
1904 Invoice Machines. T. B. Woodward, Phila. Maker.
1905 2 Book Folding Machines. Chambers, Bro. & Co., Phila. Makers.
1906 5 Iron Vices and two Wood do. Yellow Springs Vice Co., Yellow Springs, O. Makers.
1907 7 Blinds and 6 Cornices. R. W. Kensil, Phila. Maker.
1908 6 Harris' Patent Sifting Machines. S. Harris, Phila. J. Wilcox.
1909 Mason's Patent 5 min. Cream Freezer. H. B. Mason, Sunbury. J. Wilcox.
1910 Iron Bedstead. J. Wilcox, Phila. Maker.
1911 2 Sets Wright's Patent Sec. Bed Springs. J. Wilcox, Phila. Maker.
1912 Improved Gas Stoves. J. Wilcox, Phila. Maker.
1913 Portable Gas-Furnace, " " "

1914 Miniature Hook & Ladder. E. P. Hipple, Phila. Maker.
1915 5 Boy's Sledges. N. Stratton, New Haven. J. H. Allen & Co.
1916 1 Ship. C. Green, Phila. Maker.
1917 1 Quilting Frame. J. M'Devitt, Phila. Maker.
1918 Ship. Calvin Meder, Phila. Maker.
1919 3 Ventilators. H. J. White, Phila. Maker.
1920 1 Hot Water Furnace. Morris, Tasker & Co., Phila. Makers.
1921 Lot Lap Welded Flues. " " " "
1922 " Gas-fitters' Tools. " " " "
1923 Samples Tubing. " " " "
1924 2 Boynton Hot Air Self-Cleaning Heaters. A. W. Rand, Phila. Maker.
1925 2 L. W. Leeds' Water Self-Regulating Heaters, " " "
1926 4 Hays' Ventilators & Chimney Caps, " " "
1927 Lot Hot Air Registers & Soap Stone, " " "
1928 " Taps & Dies. Nelson Barrows, Phila. Maker.
1929 " Brass Work. Pike, Green & Co., " "
1931 " Sample Hand Rail. H. W. Evans, " "
1932 Planing Machine. Bement, Dougherty & Thomas, Phila. Makers.
1933 Improved Hanger. " " " " "
1934 Slide Rest. " " " " "
1935 Screwing Machine. " " " " "
1936 Engine plate pulp machine. 1 dress do. N. Gavitt, " G. Gavitt.
1937 15 Chairs. 1 Settee. Wisler & Bro., " Makers.
1938 Steam Engine. E. Williams, " "
1939 Child's Coach & Rocking Horse. C. Asker & Son, " "
1940 Rotary Knitting Machine. W. P. Uhlinger, " "
1941 2 Rachet Drills. Chas. B. Crosman, " "
1942 Friction Coupling Machine. Francis Coleman, " "
1943 Patent Bedstead Joint. C. B. Eastman, " "
1944 Jacquard Machine. W. P. Uhlinger & Co., " "
1945 Mechanic's Companion. E. Bliss & Co., Newark. H. Harris.
1946 3 Steam Engines, 1 Gas Valve, and 1 Testing Machine. Merrick & Son, Makers, Phila.
1947 1 Lot Galvanized Steam Gas Pipe. Morris, Tasker & Co., Makers, Phila.
1948 1 Tuyre Coil, " "
1949 1 Single, and 1 Double-Guard Screwing Machine, " "
1950 1 Sewing Machine. Wood & De Vaughn, Phila. Makers.
1951 1 Model Yacht. W. R. Jones, " "
1952 1 Washing Machine. Mathias Temple, Phila. Maker.
1953 3 Coal-Gas Burners. J. S. Clark, " "
1954 1 Double Lined Portable Heater. J. S. Clark, Phila. Maker.
1956 Lot Furniture. Register & Bell, " "
1957 1 Pat. Self-Supporting Scaffold. A. C. Funston, " "
1958 1 Leather Travelling Bag. C. W. Unruh, " "
1960 1 Cumming's Carriage Hub Improved. Thos. B. Woodward, Phila. Mayhew & Bro., Lancaster.
1961 1 Glass Case Boots and Shoes. Marshall & Mann. Makers, Phila.
1963 40 Boxes Candles, 1 Rock and 2 Eagles, Pat. Tallow. Garci & Co. Makers, Phila.

1964 1 Model Steam Engine. H. Mason, Maker. A. Tatem, Phila.
1965 1 Patent Street Rail. C. McEakin, W. P. Maker, Phila.
1966 1 Bundle American Gum Elastic Coated Iron. W. Butcher & Son. Makers, Phila.
1967 1 Lot American Gum Elastic Coated Iron and Pipes. W. Butcher & Son. Makers, Phila.
1968 2 Lot Paints. W. Butcher & Son. Makers, Phila.
1969 1 Lot Slates. Harford Slate Co., Harford, Md. J. S. Taylor, Phila.
1970 1 Trunk. Matthew Goss. Maker, Phila.
1971 1 Lot Gas Pipe. Murphey & Allison. Makers, Phila.
1972 1 Model Pavement Improvement. J. Yocum. Maker, Phila.
1973 3 Tube Rotary Pumps. Asa Farr, Jr., Phila. J. Young, Brooklyn, N. York.
1974 1 Fly Trap. Gilbert & Jumper, New Haven, Ct. C. Heit, Phila.
1975 2 Hand Printing Machines. J. W. Cooper. Maker, Phila.
1976 1 Patent Self-Acting Farm Gate. C. Dunbar. C. L. Lockwood, Phila.
1977 1 Lot Patent Wire Rope. J. A. Robeling, Trenton, N. J. Morris, Jones & Co.
1978 1 Improved Rotary Engine Hinge Valve. J. S. Kite. J. H. Warrington, Phila.
1979 1 Case Diamond Straps. C. Y. Haines & Co. Makers, Phila.
1980 50 Packages Pressed Flour, 50 Packages Buckwheat. H. W. & D. Hey. Makers, Phila.
1981 1 Pane Wrought Iron Vice. H. Wood, Phila. Maker.
1982 4 Bank Locks. J. H. Botterworth, Dover, N. J. G. W. Baldwin, N. York.
1983 2 Air Tight Coal Stoves. C. J. Lyndle. Maker, Phila.
1984 3 Portable Parlour Grates. " " "
1985 1 Orr's Original Patent Air Tight Wood Stove. C. J. Lyndle, Phila. Maker.
1986 1 Potato Digger. A. B. Hewlings, Phila. Maker.
1987 5 Planes. D. D. & P. Yarnall, do do
1988 1 Specimen Cannel Coal. Virginia. E. R. Morgan, Phila.
1989 2 Gas Self-Regulating Oil Cups and Gauges. W. H. Gee, N. Y. A. Camphell, Phila.
1990 1 Harrison Steam and Water Gauge. Harrison, N. Y. A. Campbell, Phil.
1991 5 Baxter's Wrenches. Baxter, Newark, N. J. do do
1992 1 Gee's Car Window Catch. W. H. Gee, N. Y. do do
1993 1 Wrought Iron Splice. Elwood Morris, Pa. Maker.
1994 2 Water Gauges. F. A. Hoyt & Co., Boston. J. L. Mitchell. Phil.
1995 1 Lot Brass Valves, Cocks, &c., for steam. Morris, Tasker & Co., Phil. Makers.
1996 1 Rotary Pump, Cast Iron Wagon Nuts, Cast Iron Planes. Seneca Falls, N. Y. Silsby, Mynder & Co.
1997 1 Bbl. Flour, 2 Bags Buckwheat. Allman & Zehnder, Phila. Makers.
1998 1 Bag Graham Flour. do do do do
1999 1 Harris Printing Press. Ruggles, Boston. G. S. Harris, Phila.
2000 1 Model Patent Ventilating Heater. John L. Kite, Phila. J. Walter, Chester Co.
2001 Power Loom. Samuel Eccles & Sons, Phila. Makers.
2002 Invoice Card Clothing. R. Kitson, Lowell, Mass. J. Armitage, N. Y.

2003 Cotton Picker. R. Kitson, Lowell, Mass. J. Armitage, N. Y.
2004 Model Stationary Steam Engine. H. Woernle, Phila. "
2005 Straw and Fodder Cutter. D. Cummings, Oswego, N. Y. W. H. Jones.
2006 Model Ice Boat. H. W. Brown, Phila. Maker.
2007 2 MacGregor Heating Stoves. Neman & Warnock, Phila. Makers.
2008 Parlor Cook Stoves. A. C. Barstow, Providence, R. I. Maker.
2009 Franklin Wood Stove. " " " "
2010 Office " " " " "
2011 Portable Forge. F. P. Flagler, Peekskill, N. Y. Wm. Steffe.
2012 Diffusive Daylight Reflector. W. F. Pullinger, Beverly, N. J. Maker.
2013 " Gas Light " " " " " "
2014 4 Morning Star Cook Stoves. A. J. Gallagher, Phila. Maker.
2015 4 Sunrise Air-tight " " " "
2016 Model Boat. T. Wright, Phila. Maker.
2017 " Yacht. A. Luffbarry, Phila. Joseph Daly.
2018 3 Patent Churns. E. Spain, " Maker.
2019 2 Sides Wax Upper Leather. Chambers & Cattell, Phila. Makers.
2020 1 Corn Planter. R. Fenwick, Brooklyn. A. Speer, Phila.
2021 1 Window Frame. A. Speer, Passaic, N. J. A. Speer, Phila.
2022 Panel Wood Mouldings. M. C. Greer, Phila. Maker.
2023 Horizontal 25 horse power Steam Engine. Morgan & Orr, Phila. Makers.
2024 Invoice Cedar Ware. Geo. H. Spain, Phila. Maker.
2025 Arm Chair patent. M. Eberhard, " "
2026 Small Foot Lathe. W. S. Blumner, " "
2027 Dust tight Ash Sifter. O. W. Goodwin, " "
2028 Model Propeller. J. Z. A. Wagner, " "
2029 Oscillating Steam Engine. E. H. Wood, " "
2030 Clark's Pat. Water Feeder. P. Clark, N. York. Snow & Hood, Phila.
2031 Pat. Ash Coal Sifter. Jas. P. Fennell, Phila. " " "
2032 Barrel Vinegar. E. Jones. " " " "
2033 3 Steam Gauges. A. Schmidt & Co., N. York. A. Campbell, Phila.
2034 Lubricator. E. J. Becker, Baltimore. I. Cochrane, Baltimore.
2035 3 Rolls Sole Leather for Machine Belting. W. F. Forepaugh, Jr. Phil.
2036 Velocipede "Young America." John Cline, Phila.
2037 Patent Malt Kiln Flooring. R. M. Stewart, "
2038 " Reclining Chair. C. Goehmann, "
2039 Washing Machine, "Wisner's" patent. E. M. Heston, Phila.
2040 " " Winslow " " " "
2041 2 Machines for Fitting Barrels and Kegs. Jacob Fry, Athol, Mass. Wm. Shaffer, Phila.
2042 2 Weissenborn Pat. Boiler Incrustation Preventer. E. W. Sargent, N. York. S. F. Conover, N. Y.
2043 2 Barrels and 10 Small bags Flour. W. B. Thomas & Co., Philada. Makers.
2044 Harris' Pat. Circular Saw. W. B. Aitken.
2045 2 Church Bells. Bernhard & Co.
2046 Soda Water Apparatus. "
2047 2 Pat. Enamelled Soda Water Fountains. "
2048 Washing Machine. E. H. Mitchell, Phila. Maker.
2049 Cabbage Cutting Machine. J. Butterfield, " " "
2050 Lot of Glue and Curled Hair. H. Gerker, Son & Co., "

2051 Salamander Safe. (tested) Evans & Watson.
2052 " " " "
2053 3 " " (new) "
2054 " " with pat. bank lock. "
2055 Set Bank Vault door with " "
2056 Pat. Alphabetical Bank Lock. "
2057 " " " " "
2058 Bbl. Flour. Wash. Bishop, Springfield, Del. Co., Pa. Smedley & Rudolph, Phila.
2059 4 Pat. Power Looms. W. Benjamin & Co., N. York, Makers.
2060 Pat. Corpse Preserver. J. Good, Phila.
2061 2 Side Boards. Thomas & Nass, " "
2062 1 Miniature Steam Boat. W. H. Jackson, "
2063 Plate Press. Geo. C. Howard, Phila.
2064 2 Barker's Pat. Pumps, " " " Maule & Brother.
2065 2 Combined Work Table & Bedstead. C. Baum, " Maker.
2066 Oscillating Steam Engine Model. G. Hirsel, Wilmington, Del. Maker.
2067 Case Transfer Rods for Engravers. G. C. Howard, Phila. Howard & Norman, Makers.
2068 2 Model Sail Boats. R. G. Wilkins, " "
2069 1 " Launch " J. W. Blackmore, Phila. Maker.
2070 2 Chilson's Pat. Warming Ventilating Furnaces. Arnold & Wilson, Phila.
2071 1 Richard " Portable " A. C. Barstow, Providence, R. I. Arnold & Wilson, Phila.
2072 1 Chilson's " Trio Stove. Chilson, Gould, & Co., Boston.
2073 4 Enamelled Pat. Ventilators. Arnold & Wilson, Phila. Makers.
2074 6 " Slate Mantels. Penrhyn Marble Co., Boston, "
2075 7 " Parlour Grates. Bent, Griffith & Co., South Carver, Mass. Arnold & Wilson, Phila.
2076 Lot Pat. Hot Air Registers & Ventilators. Tuttle & Bailey, N. York. Arnold & Wilson, Phila.
2077 " Sheet Iron Ware. C. L. Porter, Phila. Maker.
2078 2 Quarter Bbl. Buckwheat Meal. Sterling, Wyoming Co., Pa. S. C. White & Bro. Phila.
2079 Walnut Secretary. J. T. Hammitt, Phila. Maker.
2080 2 Pat. Car Seats. " " "
2081 2 Baby Jumper Chairs. J. H. Stevens, Huntingdon, Mass. E. W. Carryl.
2082 1 Dressing Bureau. Sillyman & Karcher, Phila. Makers.
2083 1 Scale. Vergennes Scale Co., Vergennes, Vt. Lyman & Bunting, Phila.
2084 Sail Boat. R. G. Wilkins, Camden, N. J. W. M'Gonigal, Phila.
2085 Card Curtain Pins. New England Glass Co., Boston. Mussey & Monroe, Phila.
2086 1 doz. Glass Paper Weights. New England Glass Co., Boston. Mussey & Monroe, Phila.
2087 Hub Boring Machine. Dole, Silver & Felch, Salem, Ohio. A. Herbert, Phila.
2088 Barrel Flour. Diver & Johns, Baltimore. J. B. Fenley, Phila.
2089 4 Bird Cages. A. Mindel, Phila. Maker. "

2090 1 Bundle Imitation Russia Sheet Iron. A. Wood, Phila. Maker.
2091 Specimens West's Pat. Galvanic Cement Roofing. W. R. & M'D. Cornell, Phila. Makers.
2092 3 Thompson's Oiling Patent. Thompson, Conn. W. R. & M'D. Cornell, Phila.
2093 2 Patent Chuck. J. R. Washburner, Conn. W. R. & M'D. Cornell, Phila.
2094 5 Pieces Belting. Thurlow, Hughes & Co., makers, Phila.
2095 Ball's Pat. Wrought Iron Cement Pipes. Pat. Water & Gas Pipe Co., Jersey City, N. J. D. Daten, Phila.
2096 Antifreezing Hydrant. Gebhard & Fields, Wilmington, Del. Makers.
2097 Pressure Water Wheel. " " " " "
2101 10 Flues, America Lap Welded. Seyfert, M'Manus & Co., Reading. Makers.
2102 1 20 Inch Lathe. W. Sellers & Co., Phila. Makers.
2103 1 Hoisting Machine, and Hangers for Shafting. W. Sellers & Co., Phila. Makers.
2104 1 25 Inch Planing Machine and Counter Hangers. W. Sellers & Co., Phila. Makers.
2105 Invoice Fire Brick and Tile. B. Kreischer and Nephew, N. J.

ALMANAC. 1857. ALMANAC.

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1857.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Jan....					1	2	3
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1857.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
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REPORT ON THE

Twenty-Fifth Exhibition of

AMERICAN MANUFACTURES,

1856.

REPORT

OF THE

Twenty-Fifth Exhibition

OF

AMERICAN MANUFACTURES,

BY THE COMMITTEE ON EXHIBITIONS.

JOHN E. ADDICKS, *Chairman.*

The Committee on Exhibitions, in presenting their Report of the Twenty-Fifth Exhibition of American Arts and Manufactures, held by the Franklin Institute in the month of November, 1856, will preface it with but very few remarks, and those only that may be required for a proper understanding of the Report.

The Committee intended to have made many suggestions of the utmost importance to the Franklin Institute, in her position toward the American Mechanic, and indicate in what manner her power might be much increased, to do that good which it is her province to exercise for the promotion of the mechanic arts of our country; but feeling convinced that speedy and decided steps must be taken by our citizens at large, to place such conveniences for future Exhibitions at the disposal of the Institute, as shall equal the imperative demand for them, the Committee will take an early opportunity to bring this matter to the notice of the public, in a separate address, in greater detail than time or space will allow in this Report.

Our previous Exhibition was held in 1854; but owing to the destruction by fire of the Museum buildings in the month of July of that year, it was with great difficulty a suitable place for even a partial Exhibition could be procured; and the same difficulty continued the following year to such a degree, that much to the disappointment of the Committee and the members of the Institute, as well as the mechanical interest of our City and State, we were obliged, for the first time, for a long period, to omit holding our usual Annual Exhibition. This year the same misfortune seemed to threaten our best exertion to procure such accommodations as are required, until we were met and aided in our endeavors by the well-known liberality and energy of our esteemed fellow-citizen,

Dr. David Jayne. Thus the present, as well as the last Exhibition, could hardly have been held at all, had it not been that this gentleman furnished us for that purpose with one of his noble buildings, that adorn our city. A month before the opening of our last Exhibition, the massive walls of the splendid Hall in which it was held, had scarcely made their appearance above the ground, but the contract was made that we should have it on a certain date, and hundreds of masons, bricklayers, carpenters, plasterers, painters, &c. were at work throughout days and nights, until the building was finished, with almost the rapidity of the magic of Eastern story; and on the day and hour advertised by us, the Committee were receiving the contributions of the mechanics and manufacturers to one of the most successful Exhibitions ever held by the Institute. The Committee on Exhibitions at this time deem it but an act of justice to tender their sincere thanks to Doctor David Jayne, for the good faith and liberality he exercised to them.

The display, in many departments, far exceeding in superiority previous years, and in all, the quantity offered was much curtailed by the want of space to accommodate them: the buildings were crowded to their utmost capacity—too much so, in many departments, for a proper view of the merit of each separate article; but this, although a source of annoyance to all, is still not to be regretted, as it has convinced all parties that the period has arrived when the Institute should possess such a hall as will fully and fairly accommodate all future Exhibitions of American skill and labor.

At the invitation of the Committee, the Governor of our Commonwealth and the officers of his administration, the Mayor and officers of the City Government, the Councils and Judges of our City, and other distinguished gentlemen, paid an official visit to the Exhibition, and the Committee with pleasure attest to the gratification that was expressed by them, at the splendid display of domestic skill and industry offered to their inspection.

Invitations to visit the Exhibition were extended to various public institutions of our City, as well as to other persons; and the acknowledgment of the courtesy from some of them, is attached to this Report.

By a resolution of the Committee all schools, public or private, were admitted at a mere nominal price, five cents for each scholar, and teachers free; but we regret to say that but few schools took advantage of the liberality, extended, solely, with a view of benefiting the youthful mind.

We are glad to inform the members of the Institute that, notwithstanding the crowded state of the rooms by visitors, especially in the evening, yet no accident of any kind occurred, and all left the exit-door in safety. The Committee consider much of this most desirable result was owing to the well-regulated police force, who performed their duty under the direction of the Chairman, with fidelity and due courtesy in its performance. The Committee is much indebted to his Honor the Mayor, Richard Vaux, for the interest he felt in this department of our duty; and to aid us in it, we were furnished by him for the whole period of the Exhibition, with a portion of his reserved force, consisting of a sergeant and fourteen officers, placed under the orders of the Chairman, who now desires to testify to their general good behavior and faithful attention to their duty.

The Committee cannot close their remarks without expressing their great obligation to the Committee on Arrangements, who so much aided in the holding of the Exhibition, and to the ladies and gentlemen who acted as judges of the various deposits; their services were most valuable, and without their kind and faithful help our labors would have been in vain.

The learned and brilliant closing Address by our talented townsman, the Hon. Henry D. Gilpin, is attached to this Report. Praise on our part would be superfluous; the perusal of it will richly repay the reader.

It is supposed by many, if not most persons unconnected with the Franklin Institute, that the holding of these Exhibitions is of great pecuniary profit—but this is an error: some have occasioned positive loss, while but few have left a profit of a few hundred dollars. The present one, in which the receipts have exceeded any previously held, will about balance its cost. That this may be more readily understood, a condensed account of finance is attached; and it will be understood that no member of the Committee on Exhibitions or of any other of our Committees received any reward for their services; the object of the Franklin Institute, in the holding of Exhibitions of American Art and Manufactures is not gain in money, but that, in accordance with its title, it may "Promote the Mechanic Arts" of our country, by the display of its skill and labor, and the award of merit due to the competitors in this honorable race for distinction.

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Statement of Receipts and Expenditures.

RECEIPTS—		
From Visitors,		$9029·74
Rent of Confectionery Room,		150·00
Advertisements and Sales of Catalogues,		198·99
Sale of Lumber,		170·95
		$9549·68
EXPENSES—		
Premiums, Printing, Clerks, Police, &c.	$4045·81	
Insurance, Labor, Lumber, Coal, &c.	2410·70	
Rent,	2000·00	
Gas,	896·26	
		9352·17
		$197·51

LETTERS.

Com'd's Off. U. S. N. Yard, Phila. Nov. 18, 1856.

John E. Addicks, Esq., Chm. F. I. Com. on Exhib.

Sir—I have this morning received your very polite invitation for myself and those under my command, to visit the Franklin Institute Exhibition.

Be pleased, Sir, for this act of courtesy, to present my thanks to the Committee, and say to them that their invitation shall be communicated to all whom it embraces.

I am, &c.,

Chas. Stewart, *Com'd.*

—

382 *Spruce Street, Nov.* 20, 1856.

John E. Addicks, Esq., Chm. F. I. Com. on Exhib.

Sir—I have received the invitation of the Committee of the Franklin Institute to make the Address at the close of their Annual Exhibition. It gives me great pleasure to comply with it. I shall be most happy to be the representative on such an occasion of that excellent institution, and also to embrace the opportunity as a Philadelphian, of expressing my high appreciation of the advancing progress, taste, and skill of those who have so successfully directed their talents to the cultivation and improvement of useful art.

With great respect,

Henry D. Gilpin.

—

Deaf and Dumb Institute, Nov. 25, 1856.

John E. Addicks, Esq., Chm. F. I. Com. on Exhib.

Sir—Permit me in behalf of the Directors of this Institution, to return many thanks to the Committee on Exhibitions, of which you are Chairman, for the privilege accorded to the mutes under their charge, of visiting the present beautiful Exhibition. The visit was exceedingly gratifying, and, no doubt, will be productive of good.

Please accept my own acknowledgments for your attention in this matter, and believe me,

Very respectfully, &c.,

A. B. Hutton,
Prin. Pa. Inst. Deaf and Dumb.

Philadelphia, Nov. 28. 1856.

John E. Addicks, Esq., Chm. F. I. Com. on Exhib.

Sir—The undersigned, to whom your Committee so confidently and liberally entrusted the circulation of the one thousand tickets* to the "Franklin Institute Exhibition," have faithfully and carefully apportioned and transmitted them to the several sections of the City, and from some sections have received very complimentary letters touching your liberality. Allow us, on behalf of all those to whom those tickets came, to thank you for your liberality, which we take occasion here to say, is but of the same piece of your former acts towards the school department.

It is always pleasant to the friends of education in all its branches, to see kindred institutions blending together their energies towards the promotion of the common cause. For your act, you have the thanks of a thousand adults, and will deserve the thanks of thousands of those who reap the advantages of the public schools.

Very respectfully, &c.,

Samuel Clarke,
Benjamin Gaskill,
Joseph Cooper.

* For the Teachers of the Public Schools of Philadelphia.

—

Girard College, Philada. Dec. 3, 1856.

John E. Addicks, Esq., Chm. F. I. Com. on Exhib.

Sir—The following resolutions were offered and unanimously adopted by the Teachers of Girard College, at a stated meeting held on Monday, December 1, 1856:

Resolved, That an expression of gratitude from the Officers of this Institution is due the Committee on Arrangements of the Franklin Institute, for their polite invitation to visit their Annual Exhibition of American Manufactures.

Resolved, That they are not unmindful of this and former kindnesses, and that the invitations of the Institute are always received with pleasure and accepted with alacrity, as every such opportunity increases in the pupils according to their different capacities, their powers of investigation and observation, awakens their ingenuity or stimulates them to exertions.

Resolved, That a copy of the above resolutions be forwarded to the Committee of the Franklin Institute Exhibition.

Very respectfully,

George J. Becker,
Secretary.

I.—Models and Machinery.

No. 1897. Dimpfel's Patent Fan Blowers, deposited by J. Kisterbock & Sons, Philadelphia. These blowers have received first premiums, and recall first premiums. Their high reputation for efficiency is so well established as to need no further recommendation.
A Recall First Class Premium.

No. 600. Magic Infallible Locks, by L. Yale, Jr., & Co., Philada. For a full description of this lock reference is made to the Journal of the Institute, July, 1856, containing a report of the Committee on Science and the Arts. The Committee on Exhibition, upon said report, award
A First Class Premium.

No. 1689. Steam and Fire Regulator, by A. Campbell, New York. An important invention, which, as its name implies, regulates the fire in steam boilers. So far as the Judges are aware, it has given satisfaction, performing all that is claimed; for its utility, *A First Class Premium.*

No. 1940. Rotary Knitting Machine, by W. P. Uhlinger, Philadelphia. Workmanship good, and very complete. *A First Class Premium.*

No. 2001. Power Loom, by Samuel Eccles & Son, Philadelphia. Blanchard's patent heddle motion its chief merit; equal to any in use for making twilled cotton goods, and displays considerable ingenuity.
A First Class Premium.

No. 2003. Cotton Picker, by R. Kitson, Lowell, Massachusetts. A good article, and worthy *A First Class Premium.*

No. 2059. Patent Power Looms, by William Benjamin & Co., New York. Very excellent for plain cotton goods, and of considerable originality. *A First Class Premium.*

No. 60. Machinists' Tools, by Darling & Schwartz, Bangor, Maine, deposited by Field & Hardie, Philadelphia. The squares deserving of merit; for accuracy of workmanship, *A First Class Premium.*

No. 1772. Model Blowing and Pumping Machine, by J. P. Ross, Lewisburgh, Pennsylvania. Beautifully made, without crank, shaft, or fly wheel; the valve motion is obtained by the movement of the main cross-head, a part of which slides in a peculiar shaped groove cut in an arm of the valve gear, so made as to gradually and properly admit and exhaust the steam by a slide valve. The Judges believe the arrangement new and valuable. *A First Class Premium.*

No. 1831. Improved Circular Saw, by N. Barlow, New York. The wood cut by this saw is as smooth as if it were planed, owing to the peculiar gouge shape of the teeth, which do not tear away the particles of wood, as in the ordinary saws, but cuts them. The uniformity of shape and size is insured in the teeth by sharpening them with a rotary milling tool, which is clamped to the saw while the teeth are being sharpened. For the improvement, *A First Class Premium.*

No. 1857. Scroll Saw, by L. Wright, Newark, New Jersey. Possessing great facility for sawing in curved lines. The saw can be quickly changed to suit different kinds of work or rate given for coarse sawing. The mode of attaching the spring to the saw by straps passing over the double pulleys, thus reducing its motion, has a great advantage in permitting the number of strokes to be increased without causing greater tremor. For perfection of general arrangement,

A First Class Premium.

No. 1696. Rope Making Machine, by Mower & Woodworth, Boston. Excellently arranged. *A First Class Premium.*

No. 1827. Adjustable Pulleys and Governor, by J. Tremper, Philadelphia. For the Governor, *A First Class Premium.*

No. 1859. Rope Machine, by T. G. Boone, Brooklyn, New York. Worthy *A First Class Premium.*

No. 1728. Hoop Splitting Machine, } American Hoop Machine Com-
No. 1729. Do. Shaving do. } pany, Fitchburg, Massachusetts, deposited by J. Phillips. Efficient, ingenious, and does its work well. For the adaptation and usefulness,

A First Class Premium.

No. 1709. Fan Blowers, by M. Alden, Philadelphia. The Judges speak in high commendation of these blowers, as being equal in all respects to any with which they are acquainted, and worthy of

A First Class Premium.

No. 1932. A 36-inch Planing Machine, by Bement, Dougherty & Thomas, Philadelphia. A good article. *A Second Class Premium.*

No. 2104. 25-inch Planing Machine and Counter Hangings, by W. Sellers & Co. Very complete, and excellent workmanship.

A Second Class Premium.

No. 394. Machinists' Tools, by J. B. Brown & Sharp, Providence, Rhode Island, deposited by W. W. Maull & Co., Philadelphia. For the standard measures, *A Second Class Premium.*

No. 1724. Grain Washing and Drying Machine, by H. N. Black, Philadelphia. Possessing some novelty of construction, and great utility, combining two well known principles of washing and drying by centrifugal velocity; appears to do its work well, but cannot answer as to quantity. *A Second Class Premium.*

No. 1908. Patent Sifting Machine, by S. Harris, Springfield, Mass. The feature in this machine consists in the manner of causing the reciprocating motion, by a grooved cam wheel, which suddenly reverses the direction of the motion. It is a good and useful article.

A Second Class Premium.

No. 1682. Patent Turning Lathe, by J. H. Gould, Philadelphia. For irregular shapes in wood, by means of patterns, having some features of originality. *A Second Class Premium.*

No. 1821. Chasing Lathe, by R. Dolby, Philadelphia. Simple, ingenious, convenient, great usefulness, and superior workmanship.

A Second Class Premium.

No. 1991. Wrenches, by —— Baxter, Newark, New Jersey, deposited by A. Campbell, Philadelphia. Adjustable by a screw; more convenient and stronger than the old monkey wrench, and more easily shifted than the key wrench. An excellent article. For the improvement, *A Second Class Premium.*

No. 1877. Blooms' Patent Mathematical Lock, by J. Blooms, Philadelphia. Of great mathematical ingenuity, requiring more time for examination than the Judges are at this time enabled to give. The Committee therefore recommend to the depositor its reference to the Committee on Science and the Arts.

No. 535. Patent Steam Valve, by Robert Cornelius, Philadelphia. A meritorious invention to regulate the temperature of apartments warmed by steam. The Judges consider the valve as original, and that it will accomplish what it claims. It having been previously referred to the Committee on Science and the Arts of the Institute, no further remark at this time is necessary.

No. 1121. Detachable Shaft Coupling, by Peter Teal, Philadelphia. A neat, convenient coupling, without bolt heads or other projections to catch the belt; will require further practical test; it is now before the Committee on Science and the Arts.

No. 29. Model Thrust Bearing for Propellers, by George T. Parry, Philadelphia. The Judges believe it to be one of the best kind for receiving and transmitting the thrust of propeller shafts. A machine of the same kind, by the same depositor, designed to sustain the weight o turn-tables, called Parry's Anti-Friction Box, received a premium at a former Exhibition.

No. 409. Two Sewing Machines, by Hunt & Webster, Boston, Massachusetts, deposited by J. Willcox, Philadelphia. Works with a simple subsidiary thread; the machine is well made, and sold at a moderate price. One of the specimens is double speeded, for rapid work.

No. 555. Model Tackle Scale, by A. B. Davis & Co., Philadelphia. A convenient form, which weighs an article during the operation of hoisting it.

No. 601. Machine-Carved Block Letters, by W. C. Murphy, Philadelphia. Much in use, and present a neat appearance.

No. 1656. Steam Pump Fire Engine, by Taylor, Campbell & Co., Brooklyn, New York. Justly proportioned, and apparently efficient; compactly arranged, and of excellent workmanship.

No. 1675. Ryan's Self-Connecting and Detaching Car Coupling, by Ryan & Griffin, Wilmington, Delaware. The model works well, but no decided opinion upon its merits can be given by our Judges. Its qualities must be tested by actual use on railroads.

No. 1687. Model Apparatus for Steam Boilers, by J. Frick, Philadelphia. Well made and ingeniously arranged, combining the usual blow-

off and safety feed valve, with alarm bell to notify cessation of the feed water. Is favorably spoken of by the Committee on Science and the Arts.

No. 1691. Portable Four Horse Power Farm Engine, by A. L. Archambault, Philadelphia. Equal to former Exhibition, at which they received a First Premium.

No. 1862. Hair Felting, by H. W. Miller, Philadelphia. A good article.

No. 1935. Screwing Machine, by Bement, Dougherty & Thomas, Philadelphia. Not new, but an excellent machine for the purpose; of good workmanship.

No. 1982. Bank Locks, by J. H. Butterworth, Dover, New Jersey. Permutation and combination; ingenious and well made.

No. 2002. Card Clothing, by R. Kitson, Lowell, Massachusetts. Answers a good purpose.

No. 2004. Model Steam Engine, by H. Wernle, Philadelphia. Very neatly made.

No. 2023. Horizontal Steam Engine, (25 H. P.,) by Morgan & Orr, Philadelphia. An excellent piece of workmanship, and was used for driving the machinery during the Exhibition.

No. 2026. Small Foot Lathe, by W. S. Blumner, Philadelphia. Excellent workmanship.

No. 2045. Church Bells, by Bernhard & Co., Philadelphia. Good tone. The arrangement for balancing is so perfect that they ring with ease.

No. 515. Shuttles, by E. Jackson, Philadelphia. Good specimens.

No. 1814. Fire Proof Safes, by Farrell & Herring, Philadelphia. Workmanship equal to any we have seen, and appears to be calculated to stand the most severe tests.

No. 2051. No. 2052. No. 2053. No. 2054. Salamander Fire Proof Safes, by Evans & Watson, Philadelphia. Two safes in this deposit have been subjected to a severe test at the late large fire which destroyed the "Artisan Buildings," in Ranstead Place, and withstood the action of intense heat for several hours. When opened, their contents were found uninjured, which is the best recommendation of their fire proof qualities. The workmanship is believed to be equal to any manufactured in the United States or Europe, for the purpose for which they are intended.

No. 1820. Double Lift and Force Pump, by W. H. Harrison, Philadelphia. Compact, easy of access, efficient, and of apparent durability.

No. 1843. Fire Escape Ladder, by G. W. Keller, Philadelphia. No improvement noticed over one that received a premium at a former Exhibition.

No. 1863. Self-Loading Cart, by Z. Butz, Lincolnton, North Carolina, deposited by H. Howson, Philadelphia. Ingeniously arranged, and deserving of trial.

No. 1880. Gum and Leather Belting, by Hoyt & Bros., New York. Very largely in use. The deposit is of excellent quality.

No. 1921. Lap Welded Flues,
No. 1922. Gas Fitters' Tools,
No. 1923. Samples Tubing,
} Morris, Tasker & Co., Philadelphia. All of the usual good style and quality of articles manufactured by this firm.

No. 1677. Hand or Power Drilling Machine, by R. Wilson, Milton, Pennsylvania. Of considerable ingenuity and originality, but very complex.

No. 1695. Model Patent Brick Machine, by I. Harman, Schuylkill co., Pennsylvania. Displays considerable ingenuity, but must be tested on a large scale before an opinion can be given.

No. 1785. Model Brick Machine, by C. Carnell, Philadelphia. For making bricks of untempered clay, less complicated than most other kinds, and is recommended by brick makers who have it in use. The construction for throwing it out of gear in case of any obstructions getting into the mould, is highly ingenious.

No. 1788. Tentering Machine, H. B. Fiske, Philadelphia. An improved mode for drying and tentering cloth; an excellent machine for the purpose.

No. 1790. Model Patent Soap Cutting Machine, by Van Hagen & Co., Cincinnati, Ohio. Of considerable ingenuity.

No. 1826. Reeds, by Beck & Doebely, Philadelphia. A good article.

No. 1833. Hawkins' Patent Universal Chuck, by E. Hawkins, Windsor Lock, Massachusetts, deposited by A. Gavitt. Not new in principle, but good workmanship.

No. 1946. Steam Engines, Gas Valves and Testing Machines, by Merrick & Sons, Philadelphia. Good workmanship and appearance. The testing machine is similar in design to that used by the United States Government. It is strong and well proportioned.

No. 1977. Patent Wire Rope, by J. A. Roebling, Trenton, New Jersey. The specimens are evenly laid and of good appearance. Those of small diameter are very flexible.

No. 1994. Water Gauges, by F. A. Hoyt & Co., Boston, Massachusetts. A copper float filled with compressed air works in a tube attached by its upper and lower end to the boiler, a connecting wire causes an index to rise and fall with the float, and point to the water level. The arrangement is not novel, but the appearance of the instrument is creditable, as by excellence of workmanship they have endeavored to overcome the defects that are inseparable from automatic water indicators.

No. 1995. Brass Valves, Cocks, &c., by Morris, Tasker & Co., Philadelphia. A handsome collection, of various sizes and shapes. Their extensive use is an evidence of their merit.

Nos. 1698 and 1699. Hand Brick Presses, by Samuel P. Miller, Philadelphia. Similar in design and execution to those previously exhibit-

ed. They are known to possess excellent qualities, are strong and well made.

No. 1706. Scales, by Fairbank & Ewing, Philadelphia. They still maintain their high character for accuracy and finish, for which first premiums have been awarded to them at previous Exhibitions.

No. 1717. Perkinpine's Axle Box, by D. R. Perkinpine, Philadelphia. More simple in design than usual, easy of access to clean or renew the working parts, and are recommended to the notice of railroad companies and car builders.

No. 1722. Ward's Self-Acting Coupling, by J. C. Ward, Philadelphia. The mechanical contrivance of this deposit requires a more extended examination.

No. 1723. Model City Railway, by D. D. Badger & Co., New York. Highly recommended.

No. 1738. Stubblefield's Steam Gauges, by Albertson & Douglass, Machine Co., New London, Conn.
No. 1739. Schaffer's Steam Gauge, Harrison, New York.
No. 1740. Schmidt & Co.'s Steam Gauges, New York.
} All deposited by W. B. Le Van, Philadelphia. These gauges are neat in appearance, but the Judges cannot express an opinion upon their merits, as no means for their accurate test was convenient.

No. 1771. Wagner's Adjustable Reciprocating Saws, by T. Mason, Philadelphia. Designed to cut boards of any thickness, without moving the log after it has been once set.

No. 2055. Bank Vault Door, with Lock attached, by Evans & Watson, Philadelphia. A very creditable piece of workmanship.

No. 2103. Hoisting Machine and Hanger for Shafting, by W. Sellers & Co. A useful article, of good workmanship.

Ordnance.

No. 1147. Wrought Iron Gun, 7-pounder, made and deposited by John Griffin. This gun is made by passing the pile, which is of peculiar construction, through rollers similar to those used in the manufacture of ordinary bar iron, thereby forming the entire gun when the whole mass is at a welding heat, in place of partial and repeated heats, as heretofore necessary when made under the hammer.

A gun made upon this plan has been tried at Fort Monroe, Virginia, by an officer of the Ordnance Department, and his report shows its great capacity of endurance under fire, and that some portions of the broken gun developed generally a *fibrous* structure in the iron, although some large crystals were noted in one part near the breech. These crystals must have been formed during the process of manufacture. The inventor states that he believes the present gun to be entirely free from them. The Judges are of opinion, from the appearance of the metal of the specimens now exhibited, as well as from the official report of the trial of the first gun made by Mr. Griffin, that a great degree of

excellence has been arrived at; and should the opinion of the inventor prove correct, that any size may be formed in the same manner without injury to the character of the material, an object will have been attained which has long occupied the attention of artillerists, and cannon may be made of sizes not heretofore practicable.

For the enterprise and skill displayed by the inventor, and the promise which the invention bears of future excellence when applied to large sizes of cannon, we award *A First Class Premium.*

II.—Wrought Iron.

One piece of ROLLED IRON, by Charles E. Smith, 4 inches width by $\frac{1}{8}$th of an inch thick, and 82 feet long. This is a very important article, designed for bands to drive machinery at mines. Its unusual length deserved especial notice, and worthy of a *A First Class Premium.*

One piece of ROLLED IRON, by Reeves, Buck, & Co., of extraordinary size, $11\frac{1}{2}$ by $2\frac{1}{4}$ inches, and 14 feet 2 inches long, weighing about 1244 lbs. Had it been deposited in time it would have been entitled to a first class premium. The Committee believe it is the largest piece ever rolled in this country. Also, one $9\frac{1}{4}$ by $2\frac{1}{8}$, 12 feet 4 inches long, weighs 896 lbs.

III.—Hardware.

No. 16. Hay and Manure Forks, by Sheble & Lawson, Philadelphia. The angular tanged spading fork is entirely new, of great merit, light and easily handled, possessing the good qualities of both spade and fork. The whole deposit is very good and fully equal to their previous one, for which they received a first premium.

A Recall First Class Premium.

No. 348. Cast Steel Scissors and Sheers, Clarenbach & Herder, Philadelphia. A good display of well finished articles, fully equal to previous Exhibition, for which they received a first premium.

A Recall First Class Premium.

No. 1. Model Tools, by George Heath and J. S. Parsons, Springfield, Delaware county, Pennsylvania, at the factory of W. Beatty & Son.—Consisting of two hundred and six pieces representing the different patterns and sizes of tools made at said factory, upon a scale of an inch and half to the foot; they are made of the best refined cast steel, well proportioned and finished. *A First Class Premium.*

No. 43. Iron and Brass Flat and Round Head Gimlet Points, Wood and Machinery Screws, made by the New England Screw Company, and deposited by Justice and Steinmetz, Philadelphia. The thread well cut, and higher up than usual, particularly on the smaller sizes. For their general good quality, *A First Class Premium.*

No. 65. Saws, by Henry Disston, Keystone Works, Philadelphia.—Ground perfectly true by Southworth's pattern process, tempered by Sylvester's machine. For handsome finish, superior grinding and excellent quality, *A First Class Premium.*

No. 423. Braces and Bitts, Saw Pads, Spoke Shaves, and other light tools, by Booth & Mills, Philadelphia. Excellent quality, good workmanship, and reasonable in price. *A First Class Premium.*

No. 505. Axes and other heavy Edge Tools, by C. Hammond, Philadelphia, of good material, well finished, and believed to be fully equal to any made. For their general good quality, *A First Class Premium.*

No. 618. Razors, by William Gilchrist, Philadelphia. Very superior. *A First Class Premium.*

No. 99. Brass Cocks, Heavy Hinges, and other Brass Work, for Ship and Steamboat use, by Morrison & Ray, Philadelphia. For quality and workmanship, *A Second Class Premium.*

No. 223. Cabinet and House Trimming Goods, by P. & F. Corbyn, New Britain, Connecticut, deposited by Miller & Wood, Philadelphia. A great variety of brass, bronze, electrotype and japanned articles. *A Second Class Premium.*

No. 228. Deposited by Bringhurst & Verree, of the Quaker City Works, Saws of nearly every description required, extremely well gotten up, style and finish very creditable, squares, bevels and case knives, very good. A large assortment of bright and black shovels and spades, the best of the kind in the Exhibition. For the general good quality of the shovels and spades, we award *A Second Class Premium.*

No. 378. Two pair Skates, by Bushnell & Tull, Philadelphia. Made for the Philadelphia Skating Club, and probably the handsomest articles of the kind ever manufactured in this city. *A Second Class Premium.*

No. 546. Brass, Plated and Enamelled Stair Rods, round, flat and twisted patterns, by Eddy & Hinchman, New York, deposited by Lyman & Bunting. By far the handsomest goods in the Exhibition of their kind. *A Second Class Premium.*

No. 185S. Harris's Improved Graduating Plane Iron, by H. Harris, Newark, New Jersey. The improvement consists in the regulating the thickness of the shaving, by a screw at the upper end of the iron, without loss of time. A very great improvement on the old form of plane iron, and at the reduction in price will probably come into general use. *A Second Class Premium.*

No. 19. Hoes and Rakes, by Smith Harper, Fox Chase, Pennsylvania. Very good tools for Agricultural purposes. *A Third Class Premium.*

No. 108. Skates in great variety, by Newark Skate Company, New Jersey, deposited by W. W. Knight, Philadelphia. All well finished. *A Third Class Premium.*

No. 115. Circular Saw Mandrils, by S. Vansciver, Philadelphia. Of superior quality. *A Third Class Premium.*

No. 418. Patent Curry Combs, by William Beach, Philadelphia. For their good qualities, *A Third Class Premium.*

No. 742. Plated Hub Bands, Buckles, &c., by the Hart Manufacturing Company, Kensington, Connecticut. A very handsome variety of bands, elegantly finished and plated. *A Third Class Premium.*

No. 28. Carriage Bolts, by Thomas S. Kelly, Philadelphia. Well made.

No. 36. Brass and Plated Stair Rods, by Wiler & Moss, Philadelphia. Well finished in every respect.

No. 43. Cast Steel Hoes, by N. B. Stevens, Norfolk, Connecticut; Hay and Straw Knives and Brier Scythes, by C. Roby & Co.; Cast Steel Butcher Knives, of the Union Works; Brass Screw Rings, Castors, &c., by Landers & Smith; Rifles, Horse Shoe Nails, &c. All deposited by Justice & Steinmetz, and have the appearance of good workmanship and quality.

No. 62. Cast Iron Branding Irons, letters and figures, by John Franklin, Philadelphia. Clear, distinct and well made, price moderate.

No. 63. Steel Blade Squares, part with spirit level in the stock and gauges, made and deposited by Thomas L. Moss, Philadelphia. All well finished.

No. 64. Butcher Knives, Trowels, &c., by Charles Disston. Well finished.

No. 76. Oyster Knives, by S. P. Miller, Philadelphia. Well finished.

No. 101. Self-Closing Gate Hinges and Fastenings, Door Butts and Carriage Gates, by Woolman & Coffin, Philadelphia. Appear well adapted and reasonable in price.

No. 554. Brass Shutter Screws, by Thomas Dodameade, Camden, New Jersey. Well finished and excellent quality.

No. 105. Shovels and Spades, by Jonathan Rowland & Son, Holmesburg, Pennsylvania. Fully sustain their good reputation.

No. 224. Fine Screw Plates, &c., by B. Martens, Philadelphia. Very meritorious and fully equal to former Exhibition.

No. 283. Cast Steel Letter and Frame Punches, by Jacobus & Schell, Philadelphia. Appear to be of the very best quality.

No. 321. Carpenters' Planes, by B. Sheneman & Bro., Philadelphia; sustain their good character.

No. 328. Towar's Patent Spring Heel Horse Shoe, with movable corks and toes, by Newbold, Safford & Co., Philadelphia. By certificates exhibited from Blacksmiths and Veterinary Surgeons, they must be a great improvement.

No. 329. Towar's Patent Creepers, by Safford & Williams, Philadelphia. Well finished, a light and easily adjusted article, for use on slippery pavements.

No. 371. Self-Adjusting Fixtures, for Rolling Window Shades, by G. L. Miller, Philadelphia. A neat article for window curtains.

No. 420. Improved Sheet Iron Bake Pans, by William Beach, Philadelphia. Oblong, with rounded corners and handles, worthy of notice.

No. 421. Meat Maul, by the same depositor. A good article at a moderate price.

No. 477. Ivory Table Cutlery, by Lamson, Goodnow & Co., Shelborne Falls, Mass.; deposited by E. W. Carryl. Well finished goods.

No. 501. Planes, by John Colton. Very good and fully equal to the best exhibited by this maker.

No. 503. Made by Walter Cresson, Philadelphia. Numerous samples of Saws for almost every use. A handsome display of very creditable goods, evincing great improvements in many respects. Also, patterns of steel blade squares, bevels, mortise gauges. All well got up and handsomely finished.

No. 506. Drawing Knives, Socket Chisels, Mowing Machine, Teeth, &c., by Whitman & Miles, Massachusetts. Well made and handsomely finished in every respect.

No. 507. Cook's Patent Auger Bitts, with Circular Cutters, by Lamson, Goodnow & Co., deposited by Caldwell & Ghriskey, Philadelphia. Decidedly the best pattern in use.

No. 509. Saw Mandrils, by J. Whitney, Winchester, Massachusetts, deposited by Walter Cresson. Good article.

No. 542. Files, by the Stamford File Company, deposited by Lyman & Bunting. Well cut, apparently of good material and excellent quality.

No. 544. Patent Cast Steel Shovels, by the Antrim Shovel Company—having welded strap which is said to be as cheap as the riveted. The sample on deposit appears to be too light in the blade except for moulders' use.

No. 556. Spirit Plumbs and Levels, by William Goldsmith, Philadelphia. A handsome assortment fully equal to any made.

No. 567. Axe, Pick and Hatchet Handles, by Philip G. Reading, Frenchtown, New York; deposited by J. E. Armorer. Very fair.

No. 579. All over Brass Plated Spirit Level and Plumb, with adjustable screw, by .L. Brooks, Great Falls, New Hampshire. A splendid article.

No. 668. Patent Horse Shoes, by N. B. Carpenter, New York, deposited by Lyman & Bunting. They require no nailing in the hoof, and in some cases may be used to great advantage, but we cannot decide upon their merits.

No. 672. Box Openers, by G. C. Taft, Worcester, Massachusetts, deposited by Lyman & Bunting. Apparently very convenient.

No. 1114. Pole Pruning Shears, by W. Stady, deposited by H. A. Dreer. Well made and serviceable.

No. 1119. Breast Drill Stock, by C. B. Crossman, Philadelphia. The best of that description brought to our notice.

No. 1124. Wrought Nuts, by Brayton Wrought Iron Manufacturing Company, New York, deposited by Lyman & Bunting. Very fair quality.

No. 1125. Silver Glass Curtain Pins, by Silver Glass Company, New York, deposited by Lyman & Bunting. Very handsome goods.

No. 1753. Iron and Brass Snuffers, by Stowe Manufacturing Company,

Plantsville, Connecticut, deposited by N. Trotter & Co., Philadelphia. For a low priced article, well made.

No. 1979. Diamond Razor Strops, by C. Y. Haines & Co., Philadelphia. A large assortment, and probably the best, at the price, in the market.

No. 1987. Planes, by E. W. Carpenter, Lancaster, Pennsylvania, deposited by D. D. & P. Yarnall, Philadelphia. Very good tools.

No. 1996. Cast Iron Bench Planes, by Silsby, Mynder & Co., Seneca Falls, New York. Very fair.

IV.—House-Building Materials.

No. 203. Glass Plate and Roofing Glass, by Philadelphia Glass Company, deposited by W. P. Walter, Philadelphia. This kind of glass on account of its extended application for building purposes has become of much importance. In the large display presented, the Company have well sustained their former reputation. The articles are of excellent quality; green glass fully equal for all practical purposes to the French imported and furnished at a third less cost. Having received a premium at a former Exhibition, we now award to the deposit a

A Recall First Class Premium.

No. 203. Vault and Ship Lights, by Philadelphia Glass Company, deposited by W. P. Walter. The improvement claimed is cutting the glass into iron or brass frames, grooves being made in the same for that purpose. The frames being heated, contracts with the glass in cooling. They appear an excellent article, strong and well made. *A Second Class Premium.*

No. 1126. Vault Lights, by G. R. Jackson & Co., New York, deposited by Lyman & Bunting, Philadelphia. Well made with flint glass lights of a prismatic form, and cemented into cast iron frames; an excellent article for diffusing light. *A Second Class Premium.*

No. 1791. Improved Window Sash, by C. P. Weaver, Philadelphia. A good improvement, an excellent arrangement of parts deserving especial notice, particularly in the City so given to window washing. For the improvement, *A Second Class Premium.*

No. 1860. Window Frame, by A. Spear, Passaic, New Jersey, is an arrangement of iron weather strips working in grooves around the sash, and also acts as a fastener; it is a good and useful improvement, and especially well adapted to protection from cold and rain when applied to French casement windows. *A Second Class Premium.*

No. 1992. Car Window Catch, by William H. Gee, N. Y., deposited by A. Campbell, Philadelphia. An excellent article for the purpose, very simple and not likely to get out of order. *A Second Class Premium.*

No. 1966. American Gum Elastic Coated Iron.
No. 1967. " " " Pipes.

No. 1968. Paints for Coating Iron. The mixture is said to consist of Spanish brown and litharge, ground with well boiled linseed oil, and is applied while the iron is in a heated state. The paint has a good body and adheres to the metal with much tenacity, has great toughness, is

not easily cracked or removed by bending; it appears to form an excellent protection from oxidization. Time and exposure to atmospheric changes will alone test its durability as good roofing material. For which reason we recommend to Messrs. Butcher & Sons, of Philadelphia, to refer the deposit to the Committee on Science and the Arts.

No. 2074. Enamelled Slate Mantels, by Penrhyn Marble Company, Boston. An exceedingly beautiful imitation of costly marbles, enamelled on slate, chaste in design and well executed. The Judges being in doubt in regard to the enamelling, recommend their reference to the Committee on Science and the Arts for further investigation.

No. 20. Roofing Slate, by Lehigh Slate Co., deposited by D. D. Jones, Philadelphia. The samples exhibited appear to have all the required good properties for that purpose.

No. 204. Roofing Slate, by Peach Bottom Slate Mining Company, deposited by S. T. Bodine, President, Philadelphia. Of good quality so far as can be judged from the sample.

No. 330. Self-Supporting Scaffold, By A. C. Funston, Philadelphia. An efficient and economical arrangement for the use of painters, plasterers, &c., and worthy of special attention.

No. 365. West's Patent Galvanic Cement Roofing, by W. R. & McD. Cornell, Philadelphia. This material is extensively used for roofing, and appears so far to give satisfaction, but will require time to ascertain its quality under atmospheric action. It is useful and important as a roofing cement, and as far as tested does, we believe, stand the influence of weather.

No. 1117. Patent Sash Fastener, by E. McClain, Philadelphia. Worthy the attention of builders.

No. 1676. Model Roof, by H. M. Warner & Co., Philada. Another composition for roofing purposes, and also extensively used. It is comparatively a new article, having been used in this City but a few years. When well prepared and carefully put on, makes a good tight covering and withstands the weather very well.

No. 1692. Dove-Tailing and Mortising Machine, by I. G. Baker, & Co., Philada. A good and useful machine, applicable to many mechanical uses for boring, tenoning and mortising, worthy the attention of carpenters and cabinet makers.

No. 1719. Model Sample Slating, by Harford Manufacturing Comp., Maryland, deposited by J. L. Taylor, Philadelphia. An exceedingly good specimen of fancy and plain slating, meriting approbation. The slate appears of good quality.

No. 1770. Device for Preventing Damage by Water, by T. Estlack, Philadelphia. A method by which surplus water can be carried from rooms to an outside flue. The attention of builders is called to the arrangement.

No. 1931. Sample Hand Rail, by H. W. Evans, Philadelphia. Ordinary good work.

No. 2022. Wood Mouldings, by M. Grier, Philadelphia. Of various styles and widths, smooth and excellent workmanship, the best assortment ever exhibited.

V.—Marble and Statuary.

No. 2098. Sculpture in Basso Relievo, (Marble,) by John Struthers & Son, Philadelphia. At a former Exhibition the Committee received collections from the visitors for the Washington National Monument, and decided with the proceeds to procure a suitable stone, the execution of which was placed in the hands of J. Struthers & Son. The figure represented, and its attendant devices, are emblematic of mechanical forces; the whole is finely designed and executed, and in the language of the Judges reflects great credit upon the Committee as well as Messrs. Struthers & Son. To the latter we award *A First Class Premium.*

No. 1828. Tennessee Marble Mantels and Table Tops, by E. K. Hess, Philadelphia. Fine specimen of American marble and good workmanship. *A Third Class Premium.*

No. 58. Marble Statuary, by J. & H. Johnson, Philadelphia. Very creditable. The female head very remarkable as a first attempt.

VI.—Stoves and Heaters.

No. 1892. Hot-Air Furnace, by Marklee & Thatcher, New York, deposited by Peters & Johnson, Philadelphia. The features most worthy of notice, are the series of pipes through the fire chamber by which a vast volume of air is circulated from the lower to the upper part of the chamber. The manner in which it cleanses itself fully preventing clogging, and the admirable arrangement by which the fire chamber is brought much nearer to the front, dispensing with the usual long feeding necks, and which prevents the cracking of the brick work and facilitates necessary repairs; for the above reason, this furnace possesses advantages over other furnaces on exhibition. *A First Class Premium.*

No. 1889. Welcome Cooking and Heating Range, by J. P. Hayes, Philadelphia. Containing two large ovens of the best construction and well ventilated, a complete hot-air chamber for warming upper rooms, with every facility for roasting and warming and heating bath water, is easily managed and cleansed. It seems to combine all desirable qualities in a cooking range. *A First Class Premium.*

No. 1664. Fire Board Stove, by Chadwick & Bro., Philadelphia. A new and useful article on the MacGregor principle for heating back buildings, ornamental in appearance and efficient. *A First Class Premium.*

No. 1669. Union Hot Air Range, by H. J. White, Philada. Similar in its character to the "Welcome," the lower oven cast iron and tubular which gives a large radiating surface. Its operation was perfectly satisfactory to the Judges. *A First Class Premium.*

No. 2105. Fire Brick and Tile, by B. Kreischer and Nephew, N. Y. Are the best ever exhibited, and this opinion is based upon actual use of them for several years. *A First Class Premium.*

No. 1920. Hot Water Furnace, by Morris, Tasker, & Co., Philada. The Judges remark that this is the best apparatus for heating by hot water that has come under their notice. The fire is under perfect control by certain self-governing valves, an uniformity of heat generated, great safety from fire; the parts are well adapted to each other, in a perfect manner and of great durability. Wherever it is in use its operation has given great satisfaction. *A First Class Premium.*

No. 2008. Parlor Cook Stoves,
No. 2009. Franklin Wood Stove,
No. 2010. Office Stove,
} deposited by A. C. Barstow, Providence, Rhode Island.

The superiority of these castings are fully admitted.

A Second Class Premium.

No. 2071. Richard's Portable Heater, by A. C. Barstow, Providence, Rhode Island, deposited by Arnold & Wilson, Philada. New in its combination and no doubt an excellent article. *A Second Class Premium.*

No. 1925. Water Self-Regulating Heater, deposited by A. W. Rand, made by L. W. Leeds, Philadelphia. Appears to be well adapted for its purpose, cast in sections; the parts are all easily fitted, and the joints being exposed, leakage is easily prevented. *A Second Class Premium.*

No. 1659. Bath Boiler, by Morris & Co., Philada. A very handsome specimen of workmanship. *A Second Class Premium.*

No. 2077. Lot of Sheet Iron Ware, by C. L. Porter, Philada. Well made of American sheet iron. Some of it is highly ornamental, and creditable to the maker. The coal and ash sifter is very useful, and deserving of general use. *A Second Class Premium.*

No. 1924. Boynton's Hot Air Self-Cleaning Furnace, deposited by A. W. Rand, Philada. A massive and powerful heater, compact and large radiating surface, which will no doubt give satisfaction, but requiring more extended investigation, is recommended to be referred to the Committee on Science and the Arts.

No. 1683. Gas Cooking Stoves, by A. Gleason, Philada. The Judges remark that they are favorably impressed with the merits of these gas stoves, so desirable for summer use, but decline awarding any premium until a further and more full investigation can take place, for which reason they recommend to the depositor their reference to the Committee on Science and the Arts.

No. 1665. American Range, by Barstow & Co., Providence, deposited by Chadwick & Bros., Philada. Very complete, with rotary top facilitating the movement of boilers over the fire, low in price and worthy of special notice.

No. 1661. MacGregor Heater, by the same depositor. The absence of the usual radiating surfaces is a principal feature in this heater, which renders it very simple in its construction, not likely to get out of order, and furnished at a low price, consuming a small amount of coal; it appears to be a powerful heater.

No. 1662. Portable Heater, by the same depositor.

No. 1663. Dining Room Heater, by the same depositor. On the same construction as above and in good style.

No. 1658. Hot-Air Cooking Range, by Morris & Co., Philada. Well known as the Congress Range, performing all required in a highly satisfactory manner. The Judges express their confidence in its merits, and recommend it to favorable notice.

No. 1657. Fire Board Stove, by the same depositors. A very useful and ornamental article for heating back buildings.

No. 1702. Lot of Stoves, by North, Chase & North, Philada. Very creditable specimens by this well known firm ; for beauty of design, fine casting, and neat finish, they compare favorably with any similar goods in the Exhibition.

No. 1983. Air-Tight Coal Stoves, by C. J. Tyndale, Phila. A good article and neat finish.

No. 1985. Portable Parlor Grates, by the same depositor. New style and attractive in appearance ; the air-tight wood stove in this deposit is long and favorably known,

No. 1953. Air-Tight Gas Consuming Coal Stove, by J. S. Clark, Philadelphia. Desirable style, and no doubt efficient, a double lined portable heater in this deposit, is well made and afforded at a low price.

No. 1667. Siddall's Self-Cleaning Furnace, deposited by H. J. White, Philadelphia. A superior article.

No. 1678. Fire Brick Tile, by Mueller & Neukumet, Phila. Of good appearance and deserving attention.

No. 2014. Morning Star Cook Stoves, } by A. J. Gallagher,
No. 2015. Sunrise Air-Tight " } Philadelphia.

A fine collection of these long and favorably known stoves ; they fully sustain their reputation.

No. 2007. MacGregor Heating Stoves, by Neman & Warnock, Phila. Beautiful in design and powerful in operation, fully sustain their reputation.

No. 1651. Hot Air Furnaces, by S. McFerran, Philadelphia. From their construction deemed a good article.

No. 1893. Parlor Stoves, by Marklee & Thatcher, N. Y., deposited by Peters & Johnson, Philadelphia. Fine specimens of workmanship and no doubt efficient in operation.

No. 2070. Chilson's Hot Air Furnace, deposited by Arnold & Wilson, Philadelphia. This heater is well and favorably known, having been in successful operation for several years, and well tested under very severe circumstances. It still preserves its reputation as a first class heater.

No. 2072. Chilson's Trio Stove, by Chilson, Gould & Co., Boston, deposited by Arnold & Wilson, Philadelphia. A good Stove on the graduation principle.

No. 2075. Parlor Grates, by Bent, Griffith & Co., South Carver, Mass., deposited by Arnold & Wilson, Philadelphia. A fine display and worthy of special notice.

VII.—Cabinet Ware and Upholstery.

No. 1736. Cottage Furniture, made and deposited by Courtney & Willetts, Philadelphia. Excellent workmanship, highly polished, tastefully painted, and sold at a very moderate price.
A Recall First Class Premium.

No. 1850. Furniture, made and deposited by G. J. Henkels, Philada. Very excellent workmanship, the carving superior to any heretofore exhibited. *A Recall First Class Premium.*

No. 1907. Venetian Blinds and Cornices, made and deposited by R. W. Kensil, Philadelphia. Fully sustains his previous reputation.
A Recall First Class Premium.

No. 1937. Chairs and Settees made and deposited by Wisler & Brother, Philadelphia. Excellent workmanship. *A First Class Preminm.*

No. 1956. Furniture, made and deposited by Regester & Bell. Highly ornamented and painted. *A First Class Premium.*

No. 2061. Two Side Boards, made and deposited by Thomas & Nass, Philadelphia. One of oak and the other of walnut, richly carved and beautiful design. *A First Class Premium.*

No. 2079. Walnut Secretary, made and deposited by J. T. Hammitt, Philadelphia. Superior workmanship and finish.
A First Class Premium.

No. 1899. Venetian Blinds, made and deposited by A. Britton & Co., Philadelphia. The painting very creditable, workmanship superior.
A First Class Premium.

No. 2050. Glue and Curled Hair, made and deposited by H. Gerker, Son & Co., Philadelphia. Excellent quality. *A First Class Premium.*

No. 2080. Patent Reclining Railroad Car Seats, by J. T. Hammitt, Philadelphia. These seats have iron frames and substantially made. They will take either an upright or inclined position at the pleasure of the passenger, and in either case are very comfortable; a person when sitting in them has all parts of his frame well supported, of great advantage to the traveler in night cars. For the great extent to which Mr. Hammitt has overcome the various difficulties in producing this seat, and its perfect adaptation to its use. *A First Class Premium.*

No. 1837. Billiard Table, by Stout and Birch, Philadelphia. Mahogany frame, marble bed, improved gum cushions, with open pockets of beautiful finish and perfectly true. The Judges speak of it in a high manner as a very superior billiard table. *A First Class Premium.*

2065. Combination Work Table and Bedstead, made and deposited by C. Baum, Philadelphia. A very convenient and useful article.
A Second Class Premium.

No. 2082. Dressing Bureau, made and deposited by Sillyman & Karcher, Philadelphia. A well made article. *A Second Class Premium.*

No. 22. Habilimentary Toilet Stand, made and deposited by David Freed, Philadelphia. Containing many novel features combined with much merit. *A Third Class Premium.*

No. 285. Furniture Polish, made and deposited by Joel Fales, Phila. After careful examination as an article, it was highly recommended to housekeepers. *A Third Class Premium.*

No. 1824. Marble Top Chess Table, made and deposited by E. Young, Philadelphia. Of high polish and good workmanship.
A Third Class Premium.

No. 490. Reclining Car Seat, McLaren & Bushor, Philadelphia. A single seat with iron frame, so arranged as to take an inclined position when required; when upright, it is held so by a trigger; it also has the advantage of being reversible in position by turning over the back. Its mechanical arrangement is ingenious, and with some slight modifications would make a good reclining car seat. *A Third Class Premium.*

No. 12. Model Windsor Chairs, made and deposited by Daniel L. Stoud, Marietta, Penna. Very tasteful and good workmanship.

No. 534. Two Patent Book Cases, by A. L. Adams, Philadelphia. Deserving of notice, creditable workmanship, and somewhat improved upon the old plan.

No. 1652. Ornamental Iron Bedstead, made and deposited by S. Macfarren, Philadelphia. A very good article combining neatness, light weight, with sufficient strength, for which qualifications it is highly recommended.

No. 1767. Rocking Chair and Workstand, made and deposited by Charles Bosse, Philadelphia. Very good articles, tastefully made.

No. 1776. One Turned Centre Table and Fruit Dish, by J. Hoover, Philadelphia. Made of fancy woods, excellent in design and workmanship.

No. 1802. Spring Beds and Bolster, made and deposited by J. E. Cresson, Philadelphia. Excellent make. We continue to entertain our good opinion of them and recommend them to the public.

No. 1830. Chairs, made by G. M. Carter, Philadelphia. Very handsome and good workmanship, reflecting much credit on the maker.

No. 1838. Fancy Etergere, made and deposited by John Henry, Philadelphia. Ornamented with moss and natural leaves, arranged with much taste.

No. 1851. Office Desk, made and deposited by D. K. & S. D. Large, Philadelphia. A good and very creditable ordinary counting house desk.

No. 1870. Patent Bedstead, made and deposited by Smith & Pugh, Philadelphia. This article appears to have a patent joint, which we consider a good improvement.

No. 1910. Iron Bedstead, deposited by J. Wilcox, Philadelphia. A very beautiful and well made article.

No. 1911. Two sets Wright's Patent Sectional Bed Springs, deposited by J. Wilcox. Are highly recommended as an excellent article.

No. 1943. Patent Bedstead Joint, by C. B. Eastman, Philadelphia. A dove-tailed joint and a very good article.

No. 2038. Patent Reclining Chair, made and deposited by C. Goehmann, Philadelphia. A very useful and good article.

No. 2025. Patent Arm Chair, by M. Eberhard, Philadelphia. A very desirable and useful article which is highly recommended.

No. 350. Piano Case, by J. F. Wilkins, Philadelphia. Made of black walnut, cut from Ashland, Kentucky. It resembles rosewood in so high a degree, that it is with some difficulty to be distinguished.

VIII.—Lamps and Gas Fixtures.

No. 620 to No. 664. A large assortment of Chandeliers, Pendants, Brackets, Girandoles, Lamps and Statues, by Cornelius & Baker, Phila., numbering more than one hundred different specimens. Most of these articles show a marked progress towards perfection both in artistic design as well as color and finish. In color and evenness of tint, the bronzes and verd antiques bear comparison with the best French. We note especially the six-light chandeliers designated "Armor Bronze," "Rococo," gilt and bronze, "Western Hunter," verd antique. For the general excellency of this deposit and the above chandeliers in particular, the Judges recommend to the Committee the award to Cornelius & Baker of the Gold Medal. Mr. Robert Cornelius being a member of the Board of Managers of the Institute, the Committee on Exhibitions, under the rules, much to their regret, are compelled to withhold the award. The Committee on Exhibitions would here remark that it will be perceived by their report of the Exhibition of 1854, that a certificate of life membership in the Franklin Institute, was awarded to Robert Cornelius, Isaac F. Baker, and William C. Baker, the members of the then firm of Cornelius, Baker & Co., of merit for their deposit in that Exhibition.

No. 59. A Collection of Gas Apparatus, by Code, Hopper & Comp., Philadelphia. Comprising a pressure register of the most approved construction, a compound pressure indicator with 7 connexions, 1 experimental gas metre, and 2 customer metres, one of which is dissected, all of which give praiseworthy evidence of skill in their construction and finish. *A First Class Premium.*

No. 1922. Gas Fitters' Tools, by Morris, Tasker & Co., Philadelphia. Well made and judiciously adapted to their different uses, being the best assortment that has been exhibited. *A First Class Premium.*

No. 1653. Locomotive Head Signals, by D. D. Miller.
No. 1763. " " " "
No. 1654. " " Radley & Hunter, New York.
No. 1655. " " J. A. Williams, Utica, "
Deposited by Pratt & Freeman, Philadelphia. All are regarded as admirable specimens of high work and finish, and may be safely recommended to railway companies as a serviceable lamp for passenger engines. All of these lamps are nearly of equal excellence, and justice requires that to each maker should be awarded *A First Class Premium.*

No. 1912. } Gas Stoves, by J. Wilcox, Philadelphia.
No. 1913. }

Considered to be well contrived for retaining and rendering useful a large portion of the heat produced with less than the usual unpleasant odor arising from the products of combustion. *A Second Class Premium.*

No. 1868. Improved Tongs for Gas Fitters and others, deposited by J. Bardsley. Deserves commendation for a convenient method of adaptation to pipes of different sizes. *A Second Class Premium.*

No. 150. Apparatus for the Generation of Rosin Gas, by N. Aubin, New York. Similar in its general arrangement to the usual miniature gas works, the chief difference being in the use of powdered rosin mixed with saw dust, in place of the ordinary feed of melted rosin. As the Judges had no opportunity to see the apparatus in action, its relative merits could not be observed. The depositor is recommended to refer it for further examination to the Committee on Science and the Arts.

No. 442. Dry Gas Metre, by —— Downs, New York, deposited by J. Wilcox, Philadelphia. An excellent specimen of workmanship, and admirably adapted to exhibit the action of its interior parts.

No. 1923. Welded Tubing for Gas and Steam, by Morris, Tasker & Co., Philadelphia. Fully sustains the high reputation of the house in this important manufacture.

No. 1971. Similar Tubing, by Murphy & Allison, Philada. Deserves equal commendation for excellent quality.

No. 2095. Ball's Patent Wrought Iron and Cement Pipes, by Patent Water and Gas Pipe Company, Jersey City, deposited by J. Slater, Phila., give evidence of progress in this new branch of manufacture.

No. 685. Gas Regulators and Metres, by The Pennsylvania Gas Regulator Company. Appear to be well made.

IX.—Tin Ware.

No. 367. } Lot of Tin and Japanned Ware, made and deposited by
No. 689. } Isaac S. Williams, Philadelphia. The form of the articles are good, and the workmanship of very fine quality, both showing marks of great improvement. The Judges at the last Exhibition considered the display of this depositor as worthy of a first premium, and now say, that with even greater propriety they make the same award for the present deposit. *A First Class Premium.*

Mr. Williams being a member of the Board of Managers, cannot, under the rules, receive any award from the Committee on Exhibitions.

No. 376. Bright Japanned and Fancy Ware, by Hadden, Carll & Porter, Philadelphia. This assortment is well made, and reflects much credit upon the makers. The additional piece for holding the lid of the preserving can in its place, is considered an improvement.

A Second Class Premium.

No. 476. Japanned Ware, made by Musgrove & Young, New York, deposited by E. W. Carryl, Philadelphia. Beautifully made, and the japanning tastefully executed. *A Second Class Premium.*

No. 1753. Machine used in the Manufacture of Tin Ware, made by The Stowe Manufacturing Company, Plantsville, Connecticut, deposited by N. Trotter & Co., Philadelphia. These machines are well made, and no doubt will answer the purposes for which they are intended. *A Second Class Premium.*

No. 324. Patent Measuring Funnels, made and deposited by A. C. Drand, Philadelphia. These may be used in many instances instead of the ordinary measure and funnel, though in some cases they might not be thought sufficiently accurate. *A Third Class Premium.*

No. 410. Self-Sealing Preserving Cans, made by Wells & Provost, N. York, deposited by J. Wilcox, Philadelphia. Convenient and applicable to the purpose. *A Third Class Premium.*

No. 474. Japanned Ware, by E. Carter & Co., New York, deposited by E. W. Carryl, Philadelphia. Well made and deserving *A Third Class Premium.*

No. 475. Japanned Goods, by Taylor Hodges, New York, deposited by E. W. Carryl, Philadelphia. These specimens show good workmanship and will prove serviceable. *A Third Class Premium.*

No. 1718. Three Milk Churns, made and deposited by Edward Evans, Philadelphia. Very durable, being made of heavy material, and the workmanship good. *A Third Class Premium.*

No. 2089. Bird Cages, by A. Nindle, Philadelphia, maker and depositor. Tastefully made, and worthy *A Third Class Premium.*

No. 134. Stone-Lined Water Cooler, by Oliver Evans, Philadelphia. A good article, which no doubt answers the purpose perfectly, with the additional advantage, that the water is more likely to keep pure in such vessels than in metallic reservoirs. *A Third Class Premium.*

No. 159. Preserving Cans, by Arthur, Burnham & Co., Philadelphia. We think well of these cans because of the arrangement of the soldering joint at the top, being one piece of metal less than is ordinarily used, which renders it less liable to the admission of air. *A Third Class Premium.*

No. 1784. Bird Cages, by S. Gunther, New York, deposited by J. Evans. Made of metal and japanned.

X.—Housekeeping Articles.

No. 8. Pickles and Preserved Fruits, by Miles B. Espy, Philadelphia. An excellent display equal to anything that has ever come under the notice of the Judges. The fresh fruit especially, deserves much praise. *A First Class Premium.*

No. 1917. Quilting Frame, by J. McDevitt, Philadelphia. A great improvement, requiring but little space when not in use. *A Second Class Premium.*

No. 50. Glass Preserving Jars, by A. Stone & Co., Philadelphia. Far preferable to the tin cans now so much in use.

A Third Class Premium.

No. 1768. Cedar Ware, by L. M. Leyrer, Philadelphia. A handsome display of neat and well made ware. *A Third Class Premium.*

No. 1829. Apple Cutting Machine, by Lark & Milner, Philadelphia, deposited by J. B. Smith, Philadelphia; very useful invention and worthy

A Third Class Premium.

No. 1882. Kindling Wood, by Conover & Reanny, Philada. Highly recommended to housekeepers as a great saving of labor.

A Third Class Premium.

No. 2039. Wisner's Patent Washing Machine, deposited by E. M. Heston, Philadelphia. Much to be admired for its simplicity and cheapness.

A Third Class Premium.

No. 1782. Flour, by H. N. Black.

No. 1840. Flour from the Genesee and Central Mills, deposited by Wright & Co.

No. 1980. Pressed Flour and Buckwheat Meal, by H. W. & D. Hey, Philadelphia.

No. 1997. Flour and Buckwheat Meal, } Allman & Zehnder,
No. 1998. Graham Flour, } Philadelphia.

No. 2043. Flour, by W. B. Thomas, Philadelphia.

No. 2058. Flour, by W. Bishop, Springfield, Delaware County, Pa., deposited by Smedly & Rudolph.

No. 2078. Buckwheat Meal, by —— Sterling, Wyoming Co., Pa., deposited by S. C. White & Bro.

No. 2088. Flour, by Diver & Johns, Baltimore, deposited by J. B. Fenley, Philadelphia. All equally good. For the buckwheat meal, the preference is given to the deposit of S. C. White & Bro., (No. 2078.)

XI.—Glass and China.

No. 158. China, plain and decorated, by C. Friese, Philadelphia. Some of this deposit are excellent specimens of china; plain and decorated Parian very good; all of which is the work of the depositor.

A First Class Premium.

No. 335. China, Granite and Earthen Ware, by Taylor, Speeler & Bloor, Trenton, deposited by J. L. Hoffman, Philadelphia. The china in this deposit is fully equal to the best heretofore exhibited; the granite is the best we have seen of American production, the body equal to standard manufactures abroad, and a little more care in finish would place them in a high rank; the whole deposit being manufactured by anthracite coal. *A First Class Premium.*

The Rockingham and Yellow Ware, maintains the high reputation these manufacturers have long enjoyed.

No. 261. So-called Enamelled and Engraved Glass, by French &

Richards, Philadelphia, is the best in the Exhibition, and the Judges remark the best ever exhibited here. The whole collection in all its variety, is beautiful in design and execution.

A Second Class Premium.

No. 675. Enamelled Stone Ware, by H. Remmey, Philadelphia.—Well formed goods, and an improvement in this useful manufacture.

A Third Class Premium.

No. 203. Glass Shades, by the Philadelphia Glass Company, deposited by W. P. Walter. These shades are equal to former Exhibition from the same maker, for which a premium was awarded.

No. 2086. Glass Paper Weights, by the New England Glass Company, deposited by Muzzy & Munroe, Philadelphia, sustain the high character of the Company for progress and enterprise.

No. 294. Ornamental Glass, by Cooper & Belcher, New York, deposited by R. Shoemaker, Philadelphia, fully sustains its excellent reputation.

No. 315. Stained Glass, by R. W. Roberts, Philadelphia. Creditable goods.

XII.—Silver Ware and Jewelry.

No. 318. Silver Centre Piece, "Good Samaritan," made and deposited by Taylor & Lawrie, Philadelphia. The design and execution of this testimonial is in every respect very superior.

A First Class Premium.

No. 434. Silver Ware, by W. Wilson & Son, Philadelphia. The beauty of design and superior workmanship of the several "Testimonials," exhibited by this firm, merit *A First Class Premium.*

No. 691. Silver Ware, by Conrad Bard & Son, Philadelphia. The articles of utility, are of excellent workmanship and finish.

A First Class Premium.

No. 164. Masonic and Fancy Jewelry, by E. F. Baton, Philadelphia. Of superior workmanship and design; the best exhibited.

A First Class Premium.

No. 198. Hair Jewelry, by Miss A. Green, Philadelphia. Artistic and beautiful work. *A First Class Premium.*

No. 309. Silver Small Ware, by G. P. Pilling, Philadelphia. Well and carefully made. *A First Class Premium.*

XIII.—Silver Plated and Britannia Ware.

No. 346. Silver Plated Ware, by J. O. Mead & Son, Philadelphia. This is the best display of such ware ever exhibited in this city; made and plated by the same manufacturer.

A Recall First Class Premium.

No. 454. Silver Plated Ware, by Hall & Boardman, Philadelphia.—Both body and plating and some of the articles are of first quality.

A Recall First Class Premium.

No. 269. Silver Plated Ware, by Hatting, Meyer & Warne, Philadelphia. In this deposit we quote the language of the Judges, as follows: "Invoice of plated silver ware, embracing a variety of pieces. As a whole it is deserving of commendation, and it requires that more than usual be said in reference to part of it; as we are informed that some of these articles were made and ornamented by a new process; accordingly the Judges selected one set of the ware for the purpose of ascertaining its merits. It appears that the manufacturers have substituted a new method in making, by which the expense of chasing is dispensed with, although the mode of manufacture is not fully known to the Judges, yet sufficient is known to enable them to say they consider it a decided improvement; because any pattern can be exactly reproduced, and at a cost which will enable the maker to sell a handsome article at a moderate price. The Judges would, therefore, desire to speak in the highest terms of this improvement in manufacturing." *A First Class Premium.*

No. 473. Silver Plated Waiters, by Jarvis & Cormerais, Boston, deposited by E. W. Carryl, Philadelphia. Plated on German silver; are of fine quality and the largest ever exhibited before the Institute.
A First Class Premium.

No. 472. Silver Plated Ware, deposited by E. W. Carryl, Philadelphia. Plating good, and some of the deposits of first quality. We notice with much favor some beautiful gold plated napkin rings, also the plating of cake baskets, and one beautiful chased pitcher; to the manufacturer *A Second Class Premium.*

XIV.—Agricultural Implements.

The Judges in this department, report that they concur in the opinion expressed by the Judges of a former Exhibition, that the Annual recurring Fairs of the numerous Agricultural Societies now engaged in fostering this most valuable of all arts, offers greater facility than can be found in our Exhibition, for testing and fairly comparing the merits of the various implements used in Agriculture, and recommend that such deposits should hereafter be discontinued in our Exhibitions.

The following are therefore enumerated, without any special reference in regard to their excellence:

No. 19. Agricultural Implements, by Smith Harper, Fox Chase, Pennsylvania.

No. 184. Fertilizer, by G. A. Leinau, Philadelphia.

No. 185. Phosphate of Lime, by the same depositor.

No. 248. Cattle Powder, by P. D. Pierce, Philadelphia.

No. 276. Horticultural Implements, by Paschall Morris & Co.

No. 1120. Gourley's Patent Harrow. Deposited by G. B. Meteers, Philadelphia.

No. 1703. Mowing and Reaping Machine, by Rockafellow & Howell, Philadelphia.

No. 1779. Agricultural Implements, by D. Landreth & Son, Phila.

No. 1737. Corn Planter, by J. D. Jeffers, Philadelphia.

No. 1752. Agricultural Implements, by Chas. Bradfield, do.

No. 1754. Clover Seed Gatherer, by Joshua Taylor, do

No. 1758. Gothic Corn Sheller, by Rogers & Boyer, do.

No. 1759. Manning's Mowing Machine, do. do.

No. 1761. Model do. by A. Herman, Camden, N. J.

No. 1834. Straw Cutting Machine, by W. Colladay, Philadelphia.

No. 1844. Hay and Grain Rake and Seed Sower, by Randall & Pratt, Delaware county, Pennsylvania.

No. 1845. Ketchum's Mowing Machine, by Howard & Co., Buffalo. Deposited by Paschall Morris & Co., Philadelphia.

No. 1847. Grain and Spice Mill, by A. Atwood, Troy, New York.

No. 1854. Pierpont's Grass and Grain Cutter, W. W. Pierpont, Salem, New Jersey.

No. 1856. Corn Sheller, by H. E. Smith, Philadelphia.

No. 1873. Churning Machine, by W. S. Reinert, do.

No. 1875. Mower and Reaper, by J. Manning, do.

No. 1878. "Young America" Feed Cutter. Deposited by C. Bradfield, Philadelphia.

No. 1976. Self-acting Farm Gate, by E. Dunbar, Philadelphia.

No. 1986. Potato Digger, by A. B. Hewling, do.

No. 2005. Cumming's Straw and Fodder Cutter, by W. H. Jones, Norristown.

No. 2018. Patent Churns, by E. Spain, Philadelphia.

No. 2020. Corn Planter, by R. Fenwick, Brooklyn, New York. Deposited by A. Spear.

No. 2049. Cabbage Cutting Machine, by J. Butterfield, Philada.

XV.—Cotton and Woolen Goods.

No. 120. Delaines, by the Hamilton Woolen Company, Southbridge, Massachusetts, deposited by Lafourcade, Coxe & Co., Philada. These goods in chasteness of design and perfectness in printing fully sustain their high reputation, and in the cashmeres the Judges consider the dyeing and printing unsurpassed, and fully equal a previous Exhibition by this Company, for which they received a Gold Medal from the Institute. The Committee on Exhibitions have unanimously resolved to recommend to the Institute, to grant to the Hamilton Woolen Company

A Recall Gold Medal.

No. 145. Delaines, by the Manchester Print Works, Manchester, N. H., deposited by J. C. Howe & Co., Philadelphia. The very rich and

bold designs of these goods are at once striking and beautiful, and the happy combinations of rich coloring and skilful printing abounding throughout the entire assortment, entitle the manufacturers to the highest premium that can be given by the Institute. The Committee on Exhibitions in accordance with the above Report, have unanimously resolved to recommend to the Institute to grant the Manchester Print Works
A Gold Medal.

No. 161. Bleached Muslins, by Wamsutta Mills, New Bedford, Mass., deposited by Wood & Erringer, Philadelphia. Fully sustain their reputation for high excellence. Having received a first premium at a former Exhibition, we award *A Recall First Class Premium.*

No. 208. Unbleached and Bleached Canton Flannels, 4-4 and 10-4 Brown Sheetings, Brown Drills, 7-8 and 4-4 Ticking, manufactured by David Longnecker, Lancaster Co., Penna., deposited by John Farnum & Co., Philadelphia. These goods fully sustain their excellent reputation and deservedly stand high in the estimation of the public. Having received a first premium at a former Exhibition, we now award them
A Recall First Class Premium.

No. 287. White Flannels, Ballard Vale Company, Mass., deposited by Farnham, Kirkham & Co., Philadelphia. The goods from this Company have very justly held a high celebrity, but the Judges consider those now exhibited surpass in fineness of texture, material, and manufacture, any thing of the kind ever before exhibited. The deposit consists of flannels made of cotton and wool, all wool, and silk and wool.
A First Class Premium.

No. 604. Fancy Cassimeres, by American Mills, Rockwell, Conn., Thomas Barrow, Jr., Agent, deposited by Hacker, Lea & Co., Philada. A new article in American goods of beautiful style and superior quality, bearing a close resemblance to French goods of same character.
A First Class Premium.

No. 160. Ladies' all Wool Shawls, by James Roy & Co., Watervliet, New York, deposited by Wood & Erringer, Philadelphia. The Judges deem this deposit the most superior in quality and style that has ever come under their notice, and they consider that for skill of manufacture, beauty of fabric, and perfection of colors, they deservedly occupy the highest rank. *A First Class Premium.*

No. 316. 6-4 Tufted Talma Cloth, by Bridgeport Woolen Mills, Bridgeport, Connecticut, deposited by J. C. Howe & Co., Philadelphia. A novel production closely resembling the foreign article of similar style, and do great credit to the manufacturer. *A First Class Premium.*

No. 162. Bed and Crib Blankets, by Newitchawanock Co., South Berwick, Maine, deposited by Pease & Brown, Philadelphia. Most superior, and excel anything heretofore seen by the Committee of this kind.
A First Class Premium.

No. 156. Table Diaper, by John Whiteside, Philadelphia. Very excellent goods and fully entitled to *A First Class Premium.*

No. 270. Cotton Cloak Linings, by Thomas Munroe & Co., N. York, deposited by Thomas R. Gill, Philadelphia. For the very great variety, perfection of coloring, beauty of style and printing, are unequalled by any your Committee have ever seen exhibited, *A First Class Premium.*

No. 397. Printed Calicoes, by Manchester Print Works, N. H., deposited by J. C. Howe & Co., Philadelphia. Beautiful in design and coloring. For superiority in printing we award *A First Class Premium.*

No. 375. Cotton and Wool Shirts and Drawers, by Newark Hosiery Company, Newark, N. J., deposited by W. E. Lockwood, Philadelphia. Of very superior texture. *A First Class Premium.*

No. 127. Fancy Cassimeres, Millville Manufacturing Co., Millville, Mass., deposited by Farnham, Kirkham & Co., Philada. Excellent styles and well made, but of ordinary wool. *A Second Class Premium.*

No. 129. Fancy Cassimeres, Broadbrook Manufacturing Co., Conn., deposited by Farnham, Kirkham & Co., Philadelphia. Are composed of silk and wool, and a fair specimen of American manufacture. *A Second Class Premium.*

No. 199. Tweeds, by Elm St. Manufacturing Co., Providence, R. I., deposited by F. G. Swan, Philada., are composed of cotton and wool, and so well blended as to entitle the goods to the rank of an Union Cassimere, closely resembling an all wool article of much higher cost. *A Second Class Premium.*

No. 686. Black Cotton Warp Cloth, J. M. Church & Sons, Middlefield, Massachusetts, deposited by Dulles & Hewson, Philadelphia. Are well made and of excellent stock. *A Second Class Premium.*

No. 233. Gingham and Checks, by James Long, Philadelphia. For the ginghams, *A Second Class Premium.*

No. 229. Spool Sewing Cotton, by B. J. Shreve, Mt. Holly, N. J. An excellent article. *A Second Class Premium.*

No. 265. Checks, by W. J. Watt, Philadelphia. These goods are deservedly popular. *A Second Class Premium.*

No. 139. Bleached Muslins, by W. A. Howard, Providence, R. I., deposited by Fales, Lothrop & Co., Philadelphia. Are highly creditable goods, and the production of a new mill. *A Third Class Premium.*

No. 128. Fancy Cassimeres, by Merrimac Woolen Company, Dracot, Mass., deposited by Farnham, Kirkham & Co., Philadelphia. Are fair goods.

No. 200. Fancy Cassimeres, Sexton's Warehouse Point Manufacturing Company, Connecticut, deposited by F. G. Swan, Philada. Very fair goods and highly creditable to the manufacturer.

No. 190. Canton Flannels, by S. Riddle, Delaware County, Penna. Fair merchantable goods.

No. 232. Table Damask Diaper, by C. Porter, Philadelphia. Are fair goods.

No. 262. Cottonades, Joseph Ripka, Philadelphia. Well made, excellent styles, and highly creditable.

No. 332. Wool in the Fleece, deposited by Coates & Brown, Philada. Are the finest that the Judges have ever examined, and fully establish the fact that wool of the finest quality can be grown in this country.

XVI.—Silk Goods.

No. 619. Oil Silks, by S. Wright & Son, Philadelphia. The colors are clean and good, and the article well got up. Having received a first premium at a former exhibition, we award *A Recall First Class Premium.*

No. 267. India Rubber Silk, by Webster & Leberman, Philadelphia. A new process as applied to silk or any other light fabric; no appreciable odor, and the colors well sustained. The deposit consists of the various articles of utility, such as dresses, cloaks, capes, &c.

A Second Class Premium.

No. 678. Machine Sewing Silk, by Gurney & Co., New York, deposited by Charles Lang. Three cord silk, quality fair, color good, and superior to former exhibition of the same article.

A Third Class Premium.

XVII.—Straw Goods.

No. 359. Case of Straw Goods, by Thomas White & Co., Philadelphia, consisting of Italian pedal hat, English patent cap, American straw hat and split straw bonnet. The sewing, bleaching, shape, and finish, are all very superior, and do much credit to the depositors. They received a first premium at a former Exhibition, and we award to this deposit,

A Recall First Class Premium.

XVIII.—Umbrellas.

No. 300. Umbrellas, by William A. Drown, Philadelphia. A collection of most excellent silk umbrellas, the handles in particular are elegant and chastely executed, and the whole deposit will compare favorably with any imported or domestic, and fully sustains this manufacturer's well known reputation.

No. 430. A small invoice of elegantly made light Silk Umbrellas, by W. H. Richardson, Philadelphia. The bamboo stick and handles, render them desirable to all who desire a light silk umbrella.

The Judges remark that umbrellas manufactured in Philadelphia are superior to any imported from Paris or London.

XIX.—Coach Work.

No. 1672. Lumber Cart, by R. B. Scott, Philadelphia. Well adapted for the purpose ; substantially built and neatly painted.
A Third Class Premium.

No. 1679. Fire Hose Carriage, by J. Young & Son, Philadelphia.—Very tasty in design and built in superior style, and very creditable to the maker. *A Third Class Premium.*

No. 1881. Children's Carriages, by Bushnell & Tull, Philadelphia. Ordinary specimens, with the exception of a four wheeled phæton, which is a neat and well finished little carriage, and for which we award
A Third Class Premium.

No. 2036. Velocipede "Young America," by John Cline, Philadelphia. Well constructed and creditable. *A Third Class Premium.*

No. 1775. Trotting Wagon, by J. S. Collins & Son, Camden, New Jersey. A very neat, proportionable, and well executed piece of work.

No. 615. Carriage Bolts, by T. & W. Shields, Philadelphia. Creditable work.

No. 1673. Cart, by R. B. Scott, Philadelphia. Creditable to the maker.

No. 1704. Patent Child's Carriage, by J. & C. Berrien, New York. Deposited by J. H. Gould, Philadelphia. A creditable article.

No. 1818. Buggy Wagon, by Lane & Co., Philada. A fair article.

No. 1861. Velocipedes, by W. Quinn, Philada. Fair work.

No. 1915. Boy's Sledges, by N. Stratton, New Haven. Ordinary specimens.

No. 1939. Child's Carriage and Rocking Horse, by C. Asker & Son, Philada. Ordinary.

XX.—Saddlery, Harness and Trunks.

No. 457. Saddles and Harness, by Lacey & Phillips, Philadelphia. This deposit shows excellent taste, in style of mounting; great care in selection of leather, beauty of finish, neatness and faultless workmanship throughout. A traveling trunk in this deposit surpasses all others in the Exhibition in perfection of workmanship, strength, convenience and finish. *A First Class Premium.*

No. 388. Cart Harness and Breeching, by M. Magee & Co., Philada. Substantial and handsome work ; intended for the Southern market.

No. 387. Saddles, by the same depositors. All over quilted side saddle and illuminated Mexican saddle; is a sample of their fine work. For the skill and workmanship in this deposit, the Judges award
A Second Class Premium.

No. 519. Leather Hat Box, by W. Topfer, Philadelphia. Beautifully stitched, with collar case and other conveniences; silk lined and padded. A superior piece of work. *A Second Class Premium.*

No. 372. Military Spur, by James S. Ewbank, Washington City. Dispensing with buckle and strap, it can be adjusted very readily to any sized heel; it being jointed, can be conveniently carried in the pocket.
A Second Class Premium.

No. 172. Patent Leather Collars, by W. R. Scott. Shows fine work and durability. *A Third Class Premium.*

No. 399. Harness and Saddles, by W. U. Moyer, Philada. A very good display.

The following Trunks and Valises are all made in good style and fair in point of workmanship.

No. 296. By T. W. Mattson, Philadelphia.
No. 516. By A. T. Hickey, do.
No. 584. By A. L. Hickey & Sons, do.
No. 1895. By J. Unruh, do.
No. 1970. By Matthew Goss, do.

XXI.—Chemicals.

In this department, the Committee on Exhibition in justice to the depositors would remark, that their limited space in this report will not allow to give in detail all the remarks of the Judges on the various specimens by each depositor. But should more than the following digest be required for publication by any depositor, a certified copy of the report in regard to his deposit, will be furnished by the Chairman of the Committee.

No. 431. } Chemicals for Medicines and the Arts, by Powers &
No. 432. } Weightman, Philadelphia. Taken as a whole in quantity, quality, variety and beauty, this deposit exceeds any other yet exhibited under the auspices of the Institute, within the recollection of the Committee. It includes 124 distinct specimens, many of them rare and beautifully crystallized.

The specimens of alum include one massive section of a tub crystallization, weighing nearly a ton. They are all ammonia alum, the manufacturers finding it cheaper to use the ammoniacal than the potash salt.

The Judges recommend a special award to the manufacturers, for the skill and enterprise presented in this deposit. The depositors at a previous Exhibition having received a Gold Medal, the Committee on Exhibition have unanimously resolved, to recommend to the Institute to grant to the depositors *A Recall Gold Medal.*

No. 236. Chemicals, by Rosengarten & Sons, Philadelphia. This invoice includes 73 specimens of chemicals and pharmaceutical preparations, which for quality and beauty fully sustains the well deserved reputation of these manufacturers. The oxide of zinc we find free from carbonic acid, with only a trace of iron and sulphuric acid; and some of the preparations are new medicinal chemicals. The Committee believe

this display to be superior to that of 1854, at which the depositors received a first premium, and now award them

A Recall First Class Premium.

No. 666. Pharmaceutical and Chemical Preparations, by Chas. Ellis & Co., Philadelphia. The general excellence of the articles in this deposit merit commendation, and fully equal those of a similar kind at a former Exhibition, when the depositor received a first premium. We now award *A Recall First Class Premium.*

No. 383. Brimstone in Rolls and Crystalline masses, refined by F. Shloss, New York, deposited by W. Gulager & Bro., Philadelphia, deserves particular notice for its fine appearance and purity.

A First Class Premium.

No. 133. Cyanide of Potassium, by H. W. Worthington, Philadelphia. The finest specimen of this important chemical that has yet been offered on exhibition. In the same deposit we notice a beautiful lot of Prussiate of potash of excellent quality. For the cyanide of potassium,

A First Class Premium.

No. 385. Ox. Cobalt, } By Buck, Simonin & Co., Philadelphia.
No. 386. Metallic Nickel, } The cobalt is so good, that it is in high repute in the pottery manufactories of England; the nickel is the best to be had in the United States. *A First Class Premium.*

No. 126. Fine Chemicals, made and deposited by Hennell Stevens, Philadelphia. These specimens, though small, possess considerable interest. For the glycerine, in view of its good quality, when it is considered that it is prepared from the crude article of commerce,

A Third Class Premium.

No. 31. Ammonia Ferric Alum, by John E. Carter, Philadelphia.—This specimen of iron alum, meets especial notice for its crystal; two of which are perfect octohedrons of two inches base. This salt has recently been introduced into materia medica, and is the first exhibition of its kind. *A Third Class Premium.*

No. 38. Prussiate Potash, by Carter & Scattergood, Philadelphia, is of excellent quality and fully sustains the reputation of the manufacturer.

No. 93. Glycerine Cream, } By H. A. Bower, Philada. The former
Seidletz Powders, } used as an emollient application to relieve chapped and excoriated skin.

No. 103. Solid and Fluid Citrate of Magnesia, by S. C. Shepherd, Philadelphia. The former is intended as a portable for the officinal solution, which tends to spoil by keeping.

No. 169. Ferruginous Chocolate, } By E. Pincus, Philadelphia. The
No. 170. Spanish do. } Spanish Chocolate is well prepared and delightfully flavored.
No. 171. Mustard for table use, }
The Ferruginous is put up in small tablets in circular boxes, and is intended as an agreeable chalybeate.

No. 231. Spread Plasters, by W. H. Pratt, Philadelphia, are well

spread; a variety of kinds such as Burgundy-pitch, hemlock, arnica, &c. They are the best in the Exhibition.

No. 244. Pharmaceutical Preparations, by E. H. Hance, Philadelphia. Consisting of 42 specimens of extracts, fluid extracts, syrups, &c., and are generally of good quality.

No. 302. Glassware, by John Capewell, Philadelphia, chiefly for druggists' furniture bottles, show jars, &c. They are well formed and free from imperfection in the crystal, but the stoppers are generally badly fitted.

No. 323. Model Pill Counter, by C. C. McGlathery, Philadelphia, by which oval boxes are filled with pills, but as the number depends upon the *size* of the pill, it should be called a pill measurer.

No. 384. Saltpetre, by C. & C. C. Henshaw, Philadelphia, crystallized and granulated. The crystals are well formed.

No. 597. Atwood's Patent Alcohol, by Z. Locke & Co., Philadelphia. Of excellent quality, free from fusel oil or whiskey odor; well suited to the purposes of the druggist and perfumer.

No. 1685. Drug Mill, by B. Swift, New York, deposited by J. G. Richardson; has been in use for a number of years in Philadelphia for small operatives in drug grinding, and has proved very efficient and useful.

XXII.—Soaps and Perfumery.

No. 263. Candles, by Thain & McKeone, Philadelphia. Stearine blocks and candles. The latter have much the appearance of sperm; burn with a beautiful white light and free from smell. *A First Class Premium.*

No. 963. Patent Economic Tallow Candles, by Garcin & Co., Philadelphia. These candles present a very neat appearance, the tallow being prepared by a chemical process which renders it whiter and harder; the candles are more durable: burn with a good flame; run less than ordinary mould; burn a longer time; will stand a higher temperature without softening, and cost no more than mould candles. One-sixth of a pound burned 8 hours, costing one-third of a cent per hour.
A First Class Premium.

No. 51. Oleine Soap, by Barry & Boyd, Philadelphia. Of very good quality for domestic use, being firm, light colored, and very detergent.
A Second Class Premium.

No. 194. Soaps, Candles, &c., by J. R. Graves & Co., Philadelphia. These depositors have received a first premium for their soaps at a previous Exhibition, and for superior adamantine candles in the present deposit, we award them *A Second Class Premium.*

No. 194. Concentrated Ley, made by Pennsylvania Salt Co., deposited by J. R. Graves & Co., Agents, is recommended to be referred to the Committee on Science and the Arts.

No. 78. Assortment of Perfumery, by E. McClain, Philadelphia. We notice particularly his shaving soap as being of excellent quality.
A Third Class Premium.

No. 11. Transparent Soap, by A. Brocard, Philadelphia. Very good.
A Third Class Premium.

No. 266. Fancy Soaps, by L. Franks, Philadelphia. Very neat imitation of the imported. *A Third Class Premium.*

XXIII.—Paints and Artists' Colors.

No. 493. Water Colors, by G. W. Osborne & Co., Philadelphia, are of excellent quality. *A First Class Premium.*

No. 299. Paints and Colors, by Gilsborough Works, Camden, N. J., deposited by J. Lucas & Co., Philadelphia. Colors generally good.

XXIV.—Wigs.

No. 461. A Case containing a large assortment of Wigs, Toupees, Curls, &c., by Richard Dollard, Philadelphia. What is called the transparent wig and toupee, are intended to show the natural skin through the fabric wherein the hair is inserted. They are extremely light and differ materially from many imitations hitherto in use. The depositor has brought this branch of manufacture to a very close approximation to nature.

XXV.—Philosophical Apparatus.

No. 533. Municipal and Railroad Telegraph and Fire Alarm, by Philips & Robinson, Philadelphia, is intended for situations where it would be operated upon by police officers and others who would not have the opportunity of learning the alphabet of the Morse instrument, and where the House instrument would be too expensive and delicate. It appears remarkably simple and effective. The fire alarm telegraph has been well tested in the city, and presents advantages over any other form yet introduced. *A First Class Premium.*

No. 32. A new Form of Protracter, by H. W. Poole, Pottsville, Pa. The Judges remark that they cannot report upon this deposit without a careful explanation and trial. They therefore recommend to the depositor its reference to the Committee on Science and the Arts.

No. 527. Air Pump, by E. S. Ritchie, Boston, deposited by J. W. Queen, Philadelphia. Very beautifully made, and with a form of upper valve which seems to be exceedingly delicate and effective. As it would require much time and a better opportunity for a fuller examination, it is suggested to the depositor to refer the apparatus to the Committee on Science and the Arts.

No. 579. Spirit Level, by L. Brooks, Great Falls, N. H., deposited by L. E. Slow, is recommended for examination to the Committee on Science and the Arts.

No. 681. Microscope, by J. Schnaitman, Philadelphia. Apparently well made. It is impossible to express any opinion regarding its merits, except by a careful trial, which can be made by the depositor referring it to the Committee on Science and the Arts.

No. 1764. Mercury Steam Gauge, by Hurford & Feast, Canton, Ohio. These deposits are recommended to the Committee on Science and the Arts.

No. 1742. Improved Mercury Gauge, by William Gee, New York, deposited by W. B. Le Van.

No. 21. Telegraphic Instruments, by Hinds & Williams, Boston. Remarkable for fine finish.

No. 49. Philosophical Apparatus, by Wilson H. Pile, Philadelphia. The specific gravity apparatus is fully equal to that which received a first premium at a former Exhibition.

No. 109. Druggists' Scales and Weights, by H. Troemner, Philadelphia. Fully equal to former displays, for which first premiums have been awarded.

No. 153. Galvanic Battery, by Dr. S. B. Smith, New York, deposited by Dr. W. H. Hazzard, Philadelphia. Neat, compact, and cheap.

No. 192. Mathematical Instruments, by H. Hartman, Philadelphia. Quite equal to those deposited by Hartman & Saxe, and for which, a first premium was awarded at a former Exhibition.

No. 214. Instruments for the Cure of Stammering, by R. Bates, Philadelphia. After a Report by the Committee on Science and the Arts, a Scott Legacy Medal and first premium was awarded at a former Exhibition. They have since been considerably improved.

No. 226. Movable Planisphere of the Heavens, by H. Whitall, Philadelphia. An exceedingly convenient and ingenious instrument. It has been favorably reported upon by the Committee on Science and the Arts.

No. 322. Mathematical Instruments, by C. A. Saxe, Philadelphia. Theodolyte of good workmanship. Lithographic ruling machine, neat and well made.

No. 336. Philosophical Apparatus, by McAllister & Co., Philadelphia. A first premium has been awarded to these depositors at a former Exhibition. The present display is of great variety and excellence.

No. 349. Mathematical Instruments, by Amsler & Wirz, Philadelphia. Fully equal to former Exhibition at which they received a first premium.

No. 396. Philosophical Apparatus, by L. C. Francis, Philadelphia. Of excellent finish and low price.

No. 494. Philosophical Apparatus, by W. C. & J. Neff, Philadelphia. The electro-magnetic machine with rolling armature, an exceedingly powerful and convenient form of the apparatus, deserving high commendation.

No. 526. School Apparatus, by Holbrooke School Manufacturing Co., Holbrooke, Mass., deposited by J. W. Queen, Philadelphia. Very good.

No. 528. Mathematical and other Apparatus, deposited by J. W. Queen, Philadelphia. A very creditable display. The Judges call attention to this depositor's reproduction of engine divided scales on card boards, fully equal to the English original Holtzapffel.

No. 529. Electro-Magnetic Machine, by S. B. Smith, New York, deposited by W. H. Hazzard, Philadelphia. Neat, cheap, and efficient.

No. 537. A Machine of Similar Construction, by Dr. Dickenson, Philadelphia, to which the same remark will apply.

No. 540. Electric Machine, by E. J. Ritchie, Boston, deposited by J. W. Queen, Philadelphia. A convenient form for certain purposes.

No. 665. Regulator Clocks, Duplex movements, by Heitel & Bro., Philadelphia. Exceedingly simple, convenient, and beautiful.

No. 1778. Scales, by Abbott & Co., Philadelphia. The beam for the weigh lock of the Union Canal appears of capital workmanship, beautifully arranged and proportioned.

No. 1864. Lightning Rods, by A. C. Brown, Philadelphia. The brush at the top is well made and of good form.

No. 2012. Diffusive Daylight Reflector, } by W. F. Pullinger,
No. 2013. " Gaslight " } Beverly, New Jersey.
A very neat form of reflector for breaking up the reflected beam of light and diffusing it through the room.

XXV.—Surgical Instruments.

No. 680. Gold and Silver Surgical Instruments, by John S. Warner, Philadelphia. Fully equal to those for which he received a first premium at a former Exhibition. *A Recall First Class Premium.*

No. 562. Surgical Instruments, by J. H. Gemrig, Philadelphia. Fully equal in design, style, finish and general excellence, to the best foreign. *A First Class Premium.*

No. 312. Restraining Apparatus for the Insane, by J. S. Fisher, Philadelphia. Excellent in design, strong and well made, deserving of general adoption. *A Third Class Premium.*

No. 210. Family Syringes, by Mattson & Co., Philadelphia. Neat, serviceable and convenient. *A Third Class Premium.*

No. 364. Glass Syringes and Bottles, by Thomas Burns & Co., Philadelphia. Sustain their reputation.

No. 305. Artificial Leg, by B. F. Palmer, Philadelphia. This apparatus has received the first premium, Scott's Legacy Medal and premium from the Franklin Institute. It is now universally admitted by those competent to judge, to be the best ever constructed.

No. 5. Surgical Bandages, by Dr. and Mrs. McClenaghan.

No. 147. Trusses and Surgical Bandages, by C. Marsh & Co.

No. 325. Trusses and Surgical Bandages, by B. C. Everett.

The before mentioned three deposits are all well designed for their purposes, and are of the highest style of finish. The Committee do not feel warranted in giving preference to one above the other.

XXVI.—Dentistry.

No. 392. Artificial Foil, Files, &c., by Jones, White & McCurdy, Philada. These gentlemen claim the following as improvements in their teeth. A close imitation of the natural organs; a great variety of shapes in conformity with nature; the thickening of the posterior edges of the canines and bicuspids, in conformity with the gradual filling out of the natural organs from the incisors to the molars; a greater capacity to withstand the extremes of temperature to which they must be exposed; the peculiar blending of the tints in imitation of nature; the shape of the bases of the gum teeth for half and entire dentures, and their more perfect adaptation to the plates with but little grinding. Also, a great improvement in the enamel surface, which is divested of that glassy, reflecting character so unnatural, and which has hitherto been so objectionable in artificial teeth. Most of these improvements, especially those which relate to the shape, articulating and enamel surfaces, are of a high order of merit, and entitle them to

A Recall First Class Premium.

No. 279. Artificial Teeth, Corundum Wheels, &c., by Orum & Armstrong, Philadelphia. The depositors present great improvements upon their previous deposit at our last Exhibition. For the improvement

A Second Class Premium.

No. 308. Artificial Teeth, Plate Work, &c., by W. C. Eastlack, Philadelphia. The plate is well finished and very creditable to the maker.

A Third Class Premium.

No. 280. Dental Furnace, by A. Marshall, Delaware. These furnaces have a good reputation. The one on exhibition appears to be well made.

No. 117. Apparatus for the production of Local Anasthesia by Refrigeration, for Dental purposes, by E. C. Stockton, Philadelphia, is very simple in construction, but as its practical value can only be tested by experience, the Committee can form no just opinion of its merits.

XXVII.—Musical Instruments.

No. 572. Guitars, by J. Berwind, Philadelphia. Very superior in tone and finish. *A Recall First Class Premium.*

No. 436. Square Piano, by Bacon, Raven & Co., New York, deposited by J. E. Gould, Philada. For purity and volume of tone, delicacy of touch and evenness of action, qualities, which constitute a perfect piano, *A First Class Premium.*

No. 462. Grand Piano, by Birgfeld & Ramm, Philada. The Judges are unanimous in awarding to this instrument, superiority of tone, but differ in the grade of premium to be recommended. The Committee on Exhibition, therefore, have decided to grant the award of

A First Class Premium.

No. 439. Organ Harmoneum, with Pedals, by Mason & Hamlin, Boston, deposited by J. E. Gould, Philada. This instrument supplies a want heretofore existing. It is specially adapted to Churches of medium size, &c. For its portability, variety and volume of tone, ease of performance, and comparatively low cost, it is superior in these respects to any reed instrument within our knowledge, and to be preferred to many organs of twice its cost. *A First Class Premium.*

No. 1127. Square Pianos, by W. Knabe & Co., Baltimore. Are very excellent in tone and action. *A Second Class Premium.*

No. 727. Grand Pianos, by T. Gilbert & Co., Boston. In some respects a very excellent instrument and deserving of honorable mention.

No. 500. Cornet-a-Piston, Silver Plated, by T. J. Weygandt, Philadelphia. This instrument is considered very superior; is made with a single turn, doing away with the many turns to be met with in the ordinary cornet, and very much improving the tone. It also has a valve midway in the turn, which permits the water to escape at the option of the performer. The Judges recommend a First Premium. But Mr. Weygandt being a member of the Committee on Exhibition, under the rules, cannot receive the Premium.

XXVIII.—Fine Arts.

No. 174 to 182. Stereoscopic Daguerreotypes, &c., by J. F. Mascher, Philadelphia. The Judges were much pleased with the locket as a ladies' companion. For the general application of the whole deposit,

A Recall First Class Premium.

No. 391. Papier Mache on Panels, made and deposited by D. D. Dick, Philadelphia. A beautiful deposit, which we consider a fine specimen of the art. *A Recall First Class Premium.*

No. 138. Fancy Bead and Brush Work, by the pupils of the Pennsylvania Institute for the Instruction of the Blind. A good display, exhibiting great taste and ingenuity. *A Recall First Class Premium.*

No. 212. Wax Fruits, Flowers and Shell Work, made and deposited by Mrs. R. Bunn, Philadelphia. For their very great beauty, and truthful imitation, *A First Class Premium.*

No. 277. Ambrotypes and Mezzographs, by Isaac Rehn, Philadelphia. The Judges would be pleased to see the art extended to the production of positive pictures upon paper, that they might be readily duplicated for scientific purposes. For the photographic views of the microscopic world, we award *A First Class Premium.*

No. 347. Embossed Veneers, made and deposited by Israel Amies. Philadelphia. A novel and useful invention of general applicability and great durability. *A First Class Premium.*

No. 368. Carved and Gilt Mirror Frames, made and deposited by A. S. Robinson, Philadelphia. Elaborately designed and elegantly executed. *A First Class Premium.*

No. 444. Photographs on Glass, by F. Langenheim, Philadelphia.—Special mention is made by the Judges of the foliage. *A First Class Premium.*

No. 447. Large Ornamental Gilt Frame, made and deposited by J. S. Earle, Philadelphia, of original design and beautiful finish, showing much superiority in gilding. *A First Class Premium.*

Nos. 449 and 450. Photographs and Portraits on Glass, by Richardson & Betts, Philadelphia. Special mention is made of stile life. (Artist's Studio.) The large untouched paper portrait and the ambrotype vignette portrait, for general excellence *A First Class Premium.*

No. 489. Case of Leather Flowers and Insects, made and deposited by A. Williamson, Philadelphia. Novel and beautiful workmanship. *A First Class Premium.*

No. 492. Daguerreotypes and Photographs, by W. L. Germon, Philadelphia. The cabinet picture of two ladies, with landscape back ground, worthy of the highest commendation for colored photography. *A First Class Premium.*

No. 508. Stained Glass, made and deposited by J. & G. H. Gibson, Philadelphia. The Judges consider it the best display yet exhibited. *A First Class Premium.*

No. 68. Ambrotypes and Daguerreotypes, by O. H. Willard, Philadelphia. For the ambrotypes, *A Second Class Premium.*

No. 94. Wax Fruit and Flowers, by Mrs. J. Caris, Philadelphia. For the flowers, *A Second Class Premium.*

No. 165. Moulding Designs and Patterns, by G. Pelman, Philada.—For beauty and delicacy of design and workmanship, *A Second Class Premium.*

No. 282. Drawing of a Locomotive, by Edward Page, Philada. *A Second Class Premium.*

No. 611. Machine Drawing, by P. Munsinger, Philada. *A Second Class Premium.*

Nos. 719 and 1115. Ivory Carvings, by Harvey & Ford, Philada.—For the images, *A Second Class Premium.*

No. 3. Ornamental Glass Panels and Table, by G. Walters, Philada. Commendable on account of their cheapness. *A Third Class Premium.*

No. 74. Drawing of a Locomotive, by Samuel Bower, Philada. *A Third Class Premium.*

No. 80. Stuffed Birds, by John Krider, Jr., Philada. Summer duck, partridges, and cedar birds. *A Third Class Premium.*

No. 173. Gilt Mouldings, by Thery & Kruse, Philada. For imitation of gilt, *A Third Class Premium.*

No. 558. Vase of Flowers, by the Misses Jones, Philada. To Miss Constantine Jones, aged 11 years, *A Third Class Premium.*

No. 1101. Rustic Figure of an Old Farmer, made throughout of the Indian Corn Plant, made by T. Fergus, West Chester, deposited by M. B. Thomas. Truly an artistic piece of work, but the Judges would be pleased to see such talent devoted to a better purpose. For this specimen of "the oldest inhabitant," *A Third Class Premium.*

No. 30. Specimens of Writing, deposited by S. H. Crittenden, Philadelphia. Worthy of notice as beautiful specimens of penmanship.

No. 104. Rosewood Imitation, by W. B. Snyder, Philada. Noticed for accuracy of imitation.

No. 337. Bronze Castings, by —— Leconte, Jr., Philada., are worthy of notice for delicacy of work.

No. 511. Acanthus Flower in Plaster, by Thomas Heath, Philada., possesses the usual qualifications of this gentleman's work.

No. 513. Painting, "Flying Cloud," by W. V. Bonfield, Beverly, N. Jersey. Meritorious.

No. 538. Hair Work, by S. E. Albrick, Philada. Creditable piece of work.

No. 601. Machine-Carved Block Letters, by W. C. Murphy, Philada. A creditable display.

No. 606. Plaster Images, by H. Maguire and F. Gossin, Philada.—Superior specimens.

No. 698. Crayon Drawing, by A. W. Janvier, Philada. Worthy of notice.

No. 700. Patent Melanotype Plate, by James Cremer, Philada. An ingenious application of a new metal to Photography.

No. 702. Large Bird Cage, by E. Mosemann, Philada. Very ornamental and ingenious.

Nos. 704 and 706. Fancy Embossed Frame and Fancy Picture, by Misses E. & C. Johnston, Philada. Worthy of notice for delicacy of execution.

The Judges are pleased to notice as the work of Alexander H. Briscoe, a bas-relief likeness of our old fellow-citizen, Henry M. Zollickoffer, it is a fine piece of workmanship, accurately modelled and beautifully finished, reflecting much credit upon the maker.

XXIX.—Books and Stationery.

No. 524. Steel Pens, called the Washington Medallion Pen, by the American Steel Pen Manufacturing Company, New York, deposited by A. Granger, New York, have a fine point, are well finished, and allow the ink to flow freely; they are superior to many English Pens.
A First Class Premium.

No. 735. Parchment Paper, by J. M. Wilcox & Sons, Philada. Quite as strong as parchment; more pleasant to write on, and from the fact that it can be afforded at about one-half the price of imported parchment, it must come into general use. We consider this article as of very great importance. *A First Class Premium.*

It may not be generally known, but as an important fact it is worthy of mention, that a paper deed is much safer as a document in a fire proof during a hot fire than the real parchment, as the latter by heat shrivels up and becomes worthless, while the former will remain unimpaired.

No. 497. Blank Books, by D. M. Hogan, Philada. Uncommon neatness and accuracy of ruling, an important item; strength and durability of binding joined with workmanlike finish.
A First Class Premium.

No. 531. Fancy Printing, by E. Ketterlinus & Co., Philada. A splendid exhibition of fancy and ornamental printing; a portion of which is comparatively a new branch of the art in this country, which has been heretofore supplied by importation. *A First Class Premium.*

No. 1905. Book Folding Machine, by Chambers, Brother & Co., Philadelphia, displays superior mechanical skill, great simplicity, and its utility is proved that with one attendant, it will perform better work than five females can by the old method. *A First Class Premium.*

No. 136. Card and Bonnet Boards, by A. M. Collins & Co., Philada. Of very superior quality and finished in an excellent manner.
A Third Class Premium.

No. 249. Map Adjuster, by W. Stott, Philadelphia. An useful application and deserving of notice. *A Third Class Premium.*

No. 275. Carmine Ink, by W. C. Bakes, Philadelphia. Superior quality. *A Third Class Premium.*

No. 1896. Patent Card Printing Press, by G. P. Gordon, New York, deposited by Howell Evans, Philadelphia. The depositor claims that this press will cut, print, and count off 10,000 cards per hour, and produce good work. For a more careful examination than the Judges have been enabled to give, it is recommended to the depositor to submit the machine to the Committee on Science and the Arts.

No. 1975. Hand Printing Press, J. W. Cooper, Philadelphia. Recommended to be referred to the Committee on Science and the Arts.

No. 731. Fife's Patent Oblique Gold Pen, by Jones & Morgan, Philadelphia, sustains fully their high reputation.

No. 18. Binding Boards, by Theodore Megargee, New Leeds Mills, Cecil County, Maryland. Superior specimens.

No. 39. Envelopes, by R. T. Knight, Philadelphia. A decided improvement over all others.

No. 75. Embossed Cards, by W. F. Scheible, Philadelphia. Rich in design and beautiful execution.

No. 134. Letter Press, by Oliver Evans. Well made.

No. 256. Blank Books, by William Mann.

No. 414. " W. F. Murphy.

No. 523. " W. H. Maurice.

All very creditable specimens of blank work.

No. 295. Eylet Machine, by H. L. Lipman, Philadelphia. Possesses a new and useful addition, increasing its convenience.

No. 310. Bibles, by J. B. Perry. Bound in the very best "Perry" style.

No. 317. Specimen of Printing, by H. A. Brown, Philadelphia. A beautiful specimen of the typographic art.

No. 425. Patent Framed School Slates, by E. Young, Philadelphia. The oval shape of the frame in many respects, renders them more desirable than the ordinary square.

No. 428. Pocket Books, &c., by F. H. Smith, Philadelphia, sustain their high reputation.

No. 488. Invoice of Fine Bound Books, by J. W. Moore, Philada. Deserving in every respect high praise.

No. 539. Daguerreotype Bibles, by Perry & Erety, Philadelphia. A new and beautiful feature in binding.

No. 591. Specimens of Printing, by Sturdivant & Maas, Philadelphia. Good work.

No. 697. Fine Bound Books, by S. F. Kerns, Philada. Decidedly of very great merit.

No. 722. Printing, by A. C. Bryson, Philadelphia. Beautiful work.

XXX.—Leather and Morocco.

No. 1835. Sole Leather, by C. B. Williams, Philadelphia. Very superior, fully maintaining the character of the deposit, for which he received a premium at a previous Exhibition.

A Recall First Class Premium.

No. 1751. Slaughtered Sole Leather, by George S. Downing & Son, Wilmington, Delaware. Very superior tannage.

A First Class Premium.

No. 1902. Dry Hide Sole Leather, by J. Hoffman, East Waterford, deposited by Prichett, Baugh & Co. Very superior.

A First Class Premium.

No. 23. Saddle Skirting, by Jacobus & Co., Newark, New Jersey. An excellent article.

No. 458. Harness Leather, deposited by Samuel S. Armstrong, Philada. Finished in good style.

No. 459. Wax Splits, by the same maker. An excellent article.

No. 1839. Shaved Harness, by James Bousted, Philadelphia. Worthy of notice for superior finish.

No. 2019. Wax Upper Leather, by Chambers & Cattell, Philadelphia. Worthy of notice, an excellent article.

No. 2035. Sole Leather Belts for Machine Belting, by W. F. Forepaugh, Jr., Philadelphia. An excellent article and worthy of honorable mention.

No. 1846. Shoe Skirting, by W. B. Geyer, Philadelphia. A fair common article.

Morocco.

No. 1819. Assorted Colored Morocco and Parchment, by J. H. Hummel, Philadelphia, deposited by J. J. Sowers. The Judges remark that they cannot speak too highly of this deposit; in point of colors and workmanship they are equal if not better than any imported stock that has ever come under their notice. *A First Class Premium.*

No. 1879. Morocco, by Samuel Buck, consisting of dyed black, French brush kid, and brush grained, all of very superior quality. *A First Class Premium.*

No. 303. Glazed Curracoa Kids, by G. S. Adler, Philada. Worthy of *A Second Class Premium.*

No. 304. Bronze Kid, Joseph Nevil, Philadelphia. A fair article.

No. 362. Striped Sheep Binding, by J. H. Hummel, Philadelphia. Deserving of notice as having been gotten up in a creditable manner.

Patent Enamelled Leather.

No. 7. A Large Invoice of Assorted Colors, Patent Enamelled Leather, by Halsey & Taylor, Newark, New Jersey, deposited by I. Barton & Co., Philadelphia. After a careful examination on the part of the Judges it is reported as being fully worthy *A First Class Premium.*

XXXI.—Boots and Shoes.

No. 468. Ladies' Shoes and Gaiters, by J. W. McCurdy & Son, Philadelphia. Of good quality and superior workmanship, not made for the purpose of Exhibition, but regular Sales. *A First Class Premium.*

No. 340. Water Proof Boots, by James J. Halsell, Philada. Very creditable.

No. 393. Wooden Soled Shoes, by M. & J. Robinson, Philadelphia, are very useful to stand in the water.

No. 614. Ladies' High Boots, by J. T. Warren, Philadelphia. Worthy of special notice for displaying good taste and skill, and very creditable workmanship.

No. 715. Coarse Brogans of Extra Size, as a Sign, by Farley, Morrison & Co., Mass. A well made durable article.

No. 1961. Boots and Shoes for Gentlemen's use, by Marshall & Mann, Philadelphia. Creditable work. The heavy brogans deserve particular notice on account of their useful and substantial qualities.

No. 86. Crimping Machine, by George Fetters, Holmesburgh, Penna. Believed to possess great advantage over the old method.

No. 157. Boot and Shoe Lasts and Trees, by Jacob Foster, Philada. Very creditable.

No. 291. Ladies' Shoe Lasts, by S. S. Redifer, Germantown. Very fair specimens.

No. 1777. Lasts for Stitching and Clamping Boot Trees, by George Munroe, Philadelphia. Highly creditable.

XXXII.—Furs.

No. 320. Assorted Fancy Furs and Carriage Robe, by L. Fishblatt, Philadelphia. The ladies' Talma of Siberian squirrel is a superior piece of work, and some of the other pieces display very good workmanship. The carriage robe with eagle centre is good in design, well matched, and of excellent workmanship. For the carriage robe,

A Recall First Class Premium.

XXXIII.—Gentlemen's Furnishing Goods.

No. 481. Furnishing Goods by Oldenbergh & Taggart, Philadelphia. Their display of stock cravats are worthy of special notice as superior articles. Their shirts have a decided advantage in accuracy of cut, and certainty of fit in any number made. For the shirts

A Second Class Premium.

No. 221. Fancy Shirts, by Mrs. Shaeffer, Philadelphia. Workmanship and display very creditable.

No. 376. Patent Enamelled Shirt Collars, by E. H. Valentine & Co., New York, deposited by W. E. Lockwood, Philada. A desirable article for travelers. Worthy of special mention for their economy and utility.

No. 560. Furnishing Goods, by J. Burr Moore, Philadelphia. A creditable display, and worthy of notice for good style and handsome finish.

No. 613. Furnishing Goods, by Miss H. Souder, Philadelphia. Fine specimens of needlework and general good taste.

XXXIV.—Needlework.

No. 206. Embroideries, made and deposited by E. Grosjean, Philada. Very elegant, equal to any imported. *A First Class Premium.*

No. 536. Furnishing Goods for Ladies' and Children's use, by Miss M. L. Spooner, Philadelphia. For superior taste and workmanship, *A First Class Premium.*

No. 85. Crochet Work, by Miss A. B. Warrington, Camden, N. J. Very handsome. *A Third Class Premium.*

No. 91. Crochet Counterpane, by W. Knocke, Philadelphia. Beautiful work. *A Third Class Premium.*

No. 352. } Dressing Gowns, Shirt Bosoms, and Children's Linen, by
No. 353. } Madame Segorri, Philadelphia. For the specimen of card
No. 354. } machine sewing, *A Third Class Premium.*

No. 70. Stitched Quilt, by Mary McClain, Philada., (age 73 years). Worthy of particular notice.

No. 230. Zephyr Portrait, by Mrs. A. B. Linderman, Philadelphia. Deserving much credit.

No. 245. Needlework, by Miss Williams, Philadelphia. Very evenly finished.

No. 257. Leather Fruit, by Anna M. Melvin, Philadelphia. Well done.

No. 445. Quilt, by Harriet L. Savage, Philadelphia. Exhibits great patience, and is worthy of much merit.

No. 52. Piano Cover, by Miss E. Isaacs, Philadelphia.

No. 53. " Miss Ellen Myers, near Bristol, Bucks Co., Penna. Both the above piano covers very creditable to the makers.

XXXV.—Fancy Goods.

No. 319. Dressing Cases, Writing Desks, and other Fancy Articles, by W. T. Fry, Philadelphia. A very beautiful display, reflecting great credit upon the maker. *A Recall First Class Premium.*

No. 281. Hair Work, by Mrs. Reese, Philadelphia. Tasteful in arrangement, displaying much industry and great ingenuity. *A First Class Premium.*

No. 485. Model Cottage, by James A. Snyder, Philadelphia. A very beautiful piece of workmanship, correct in scale, and showing great artistic merit. *A First Class Premium.*

No. 100. Fancy Bonnets, by Madame M. Elsberg, Philadelphia. In good taste, *A Second Class Premium.*

No. 702. Bird Cage, by E. Mosemann, Philadelphia. Novel in arrangement and creditable. *A Third Class Premium.*

No. 682. Porte Monnaies, Pocket Books, and other fancy articles, by C. Rumpp & Co. Philadelphia. A display of good workmanship. *A Third Class Premium.*

No. 80. Stuffed Birds, by John Krider, Jr., Philadelphia. Beautifully prepared. *A Third Class Premium.*

No. 389. Miniature Locomotive and other Fancy Articles in Bead Work, by N. B. Kneass, Jr., 12 years of age and blind. *A Third Class Premium.*

No. 82. Tin Ship "Flying Yankee," by H. B. Butcher. For novelty and ingenuity, *A Third Class Premium.*

No. 155. Walking Canes, by George Doll, Philadelphia. A great variety and in good taste. *A Third Class Premium.*

No. 3. Ornamental Glass Panel and Table, by G. Walters, Philada. Beautiful design and good workmanship. *A Third Class Premium.*

No. 14. Ostrich Feather Brushes, by L. G. Hanson & Co., Philadelphia. A beautiful display skilfully arranged. *A Third Class Premium.*

No. 360. Fancy Silk Bonnets, by Thomas White & Co., Philadelphia. A creditable and tasty display.

OMISSIONS

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I.—Models and Machinery.

No. 2101. 10 American Lap-Welded Flues, by Seyfert, McManus & Co., Reading, Pennsylvania. Some of these flues are of extraordinary size, the largest being 22 feet long, 7½ inches in diameter, and are worthy of especial notice. The iron flanches well, and seems to be of first quality. For improvement in manufacture, *A Recall First Class Premium.*

No. 2012. 1 20-inch Lathe, by William Sellers & Co., Philadelphia. A complete machine; workmanship excellent.

A Second Class Premium.

No. 2042. 2 Weissenborn's Patent Boiler Incrustation Preventer, by E. W. Sargent, New York, deposited by S. F. Conover, New York.—An apparatus designed to separate the mineral ingredients from the feed-water of steam boilers. This apparatus demands a more thorough investigation than can be given by the Committee at this time; they therefore recommend that it be submitted to the Committee on Science and the Arts.

No. 1678. Lot of Fire Brick and Tile, by Mueller & Neukamet, Philadelphia. A good article; highly recommended by those who have used them.

No. 2063. Plate Press, by George C. Howard, Philadelphia. Of excellent workmanship.

No. 2092. Thompson's Patent Oiler, by —— Thompson, New York. The best in use.

No. 2097. Pressure Water Wheel, by Gerhard & Fields, Wilmington Delaware; useful in some situations.

CHARACTER OF FRANKLIN.

ADDRESS

DELIVERED BEFORE

The Franklin Institute,

ON THE

EVENING OF THE FOURTH OF DECEMBER, 1856.

BY

HENRY D. GILPIN.

CORRESPONDENCE.

—

FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA.

Philadelphia, November 19, 1856.

To HENRY D. GILPIN.

DEAR SIR:—I am instructed, by the unanimous request of the Committee on Exhibitions, to invite you to deliver the Address at the close of the present Exhibition, before the Officers and Members of the Institute, and the Depositors at the Exhibition.

Your favorable assent is respectfully and earnestly solicited, and will be a source of great satisfaction.

Very faithfully yours,

JOHN E. ADDICKS,
Chairman.

—

Philadelphia, November 19, 1856.

To JOHN E. ADDICKS, *Chairman.*

DEAR SIR:—It gives me great pleasure to comply with your invitation on behalf of the Franklin Institute. Nothing can afford me greater gratification than to assist, by any means in my power, the excellent objects of an Association which has contributed so much to the intelligent promotion of useful art.

Very faithfully yours,

HENRY D. GILPIN.

ADDRESS.

We meet together this evening to witness the close of another Exhibition of the productions of mechanic art. In the midst of a wide and prosperous city, whose inhabitants number more than half a million; in a noble hall, adorned by artistic skill; this large assemblage unites in the annual ceremony, by which Philadelphia commemorates the establishment of an Institution whose object is to develop, to improve, and to reward the progressive excellence of practical genius and skill; an Institution which, founded on voluntary association, sustained by united and voluntary patronage and exertion, was the first, either on this continent or the old, to combine, for the benefit of those who should devote their industry to the occupations of mechanic art, the means of instruction; the opportunities for study; aid from all the branches of advancing science; the exhibition of new discovery and improving skill; the diffusion of progressive knowledge; and the original investigation of subjects of practical usefulness, by means of actual experiment and research.

There had indeed been occasional and partial instances, where governments had extended to practical science and mechanic art, something of the patronage they profusely lavished on that which ministered to ornament, luxury, or power. In some countries, schools for such instruction had been organized; in others, cabinets, museums, libraries, and collections of useful models and machines had been formed; associations of men of science, usually students or experimentalists, who mutually communicated and disseminated their discoveries and researches, were not unknown; but I am not aware of the existence of an institution, before the Franklin Institute was founded in Philadelphia, which had the combined aim and result to make the mechanic and the practical operative an agent in the increase of such knowledge; to bring together, in common and voluntary co-operation, for the purpose of improvement, those who can impart and those who desire to receive it—the young who are seeking it, the mature who have acquired it by experience and thought; to spread the information to be gained from books and cabinets, so generally and easily, that it shall reach without trouble, and almost without cost, the humblest work-shop; to give instruction on the various branches of practical industry and the sciences connected with them, in a form so popular, and with arrangements so convenient, that they shall not interfere with, but rather aid, the daily pursuits of actual and busy labor; to diffuse, at

short intervals and in a cheap and convenient form, by means of a well conducted periodical work, every fact and suggestion in regard to every branch of practical industry, which thought, intelligence, and invention shall from time to time disclose, in any part of the world; to collect year after year, in well arranged public exhibitions, the results of mechanic labor, so that they shall contribute at once to make known the skill and genius of the artificer, to offer to artisans the opportunity of comparing useful inventions in their respective trades, and to display to all our citizens, works and objects of utility in various forms, which might otherwise remain partially or totally unknown; to reward by public reports, certificates, and premiums, the successful efforts that may be made, so as at once to confer on industry and skill a just and honorable distinction, and to give to the community the impartial assurance of the reality of merit; finally, to submit to the test of skilful, competent, unprejudiced investigation, inventions and discoveries, which, without this, may, even when beneficial, fail to obtain the confidence and patronage assured to them by such a proof, and, if visionary or deceptive, may be prevented from causing disappointment, or inflicting injury, or gaining a reputation which is undeserved.

The day has gone by when it is necessary to assert, much less to vindicate, the utility of objects such as these. None doubt the advantage, nay, the necessity of kindred science, to the prosperous exercise of every mechanic art. No builder is now ignorant that the strength of his edifice is assured by his accurate knowledge of the laws which regulate the strength of iron or of timber, or the properties of the arch, as well as that its beauty and proportions are dependent on the observance of rules as precise as those which make the dome of Saint Peter's or the porticos of the Parthenon the admiration of the world. It is chemistry, scientific chemistry, which now gives easy and cheap fertility to the farmer's abandoned field, and discloses to the painter the hidden mystery of colors as bright and unfading as those of Titian. Every man who now holds in his hand the implements of his trade, or practises the daily and usual operations of his craft, knows that it is capable of improvement by his own application to it of scientific knowledge. He knows that it is science, not chance, which is every day bringing to light discoveries and inventions that facilitate the labors and enlarge the comforts and power of man.

It was not chance, but the application of ascertained principles of science to the object sought for, that gave us the steam engine of Watt, the steamboat of Fulton, the loom of Cartwright, the gin of Whitney, the photograph of Daguerre, the telegraph of Morse, the clipper of Stearns, the reaper of McCormick. It was not by chance, but through long years of patient labor, that Guttenburg perfected the most influential of the arts invented by the genius and industry of man. Through what thoughtful and laborious nights and days, did Newton apply all the resources of science, to assure himself of the laws, now apparently so simple, that regulate the movements of millions of worlds. Is it chance that has enabled Maury to point out paths over the trackless and stormy ocean, shorter and safer than those traversed for centuries by sea-trained mariners, when unguided by the light of science that he has now cast upon them?

Was it not purely the application of science that enabled Leverrier to direct the distant telescope of Galle to the point where, in the midst of thousands of twinkling stars, he should detect an undiscovered planet rolling in its unmeasured orbit; and is it not to him, as to Columbus, even less glory to have found than to have sought for an unknown world, led as they were to the search by predictions of which they had assured themselves by experiment and science? No! The spirit of useful discovery rises not at the call of fancy; she answers only the invocations of labor and research. In every branch of human industry, from the humblest to the highest, the application of science is the sole guaranty of improvement or even of success. To foster such an application, by means of wise and well adapted public institutions, has come to be the demand and the duty of our age.

If, then, it is an honor justly due to Philadelphia, that she has successfully led the way in an object of such wise beneficence, by the comprehensive plan she framed and has developed; if we see around us every useful art, pursued by mechanics trained in her schools, with an excellence that can scarcely be surpassed, by her Baldwin, her Merrick, her Cornelius, and many a name that has become a warrant for united science, intelligence, and taste, in works of utility and elegance; if this is her just pride, now in these days of her matured prosperity, may I not, on this occasion—can there be one more appropriate—claim for her an honor still more deserving of commemoration; may I not recall the fact that, in all she is now doing, she is but fulfilling a promise that she gave in the very outset of her social career, that she is but carrying into complete and successful effect, designs that she formed, and efforts that she made a century ago?

In days when Philadelphia was yet young and feeble, she already sought, by exertions almost beyond her means, to foster mechanic industry; to encourage and honor those who should devote to it their aid and skill; to instruct its commencement, and to enlighten its further progress; to make more acceptable useful discoveries and information; to supply by voluntary and well regulated co-operation of individuals, that beneficial influence and power which the government at home and abroad was unable or unwilling to bestow. It is her just and honest pride that, at a period so early, the liberality and wisdom of her citizens laid the foundations of this popular advancement and diffusion of useful knowledge; and let us never forget that in this she was largely guided by the counsels and example of the most illustrious of her sons. May I not then justly and appropriately ask you, as the best commemoration of this anniversary, to unite with me in exploring the manner in which those early foundations were laid; in recalling the lessons that have been left to us in the life and conduct of Franklin; in examining with what fidelity we have followed the spirit of his counsels, and are entitled to the profit and glory of his honored name. Such an examination will enable us to know whether our part has been well performed; whether, as new opportunities have arisen, we have dutifully enlarged the edifice which he founded; and we shall also be able best to estimate our own advancement, as years

have rolled on, and demands and facilities have alike increased, by ascertaining the development and improvement we may have assisted to make, in the plans of useful benevolence that he formed.

When this now busy and wide extended site of bustling and active commerce, was but a scene of rural beauty; when scarcely ten thousand persons spreading along the shores of the Delaware, formed its entire population, in the month of October, 1723, exactly a century before the Franklin Institute was founded, the printer's boy, by whose name it is at once honored and described, adopted Philadelphia as his home—the home of his choice and love—his happy home as he proudly called it in his early, industrious, self-relying boyhood; his "dear Philadelphia," as he continued to name it, in the last years of his lengthened life, and in the private record of his daily thoughts and actions. He chose it for that career of honest practical labor on which he determined, with wisdom beyond his years, to found, at the outset, the basis of his fortunes; and when industry, and integrity, and length of days, and action after action of generous and considerate benevolence, private and public, to his country and his fellow men, had united to bestow upon him competence and honor; and when his bones were laid in our midst, in the humble sepulchre, he had himself directed, with no gaudy funereal honors, but with thickly coming testimonies of admiration, not from his own land alone, but from every quarter of the civilized world; he had left us, what was better even than the multiplied benevolence of his actions, the proof, made unanswerable by his own example, that practical, intelligent, persevering industry, actuated by generous impulses, and governed by a sense of constant duty, can achieve for itself the individual competence and independence which are the just aim of all; and, with these, can unite a fame the most brilliant, and stations the most exalted, to which true ambition can aspire.

Perhaps in the varied and eventful story of human life, no instance can be found of success so brilliant from an outset so cheerless. Born in a humble station, Franklin resolutely threw himself upon the wide world, with absolutely nothing to depend upon but the mechanic trade he had but begun to learn, and the resources of his own intelligence and exertion. When he wandered unknown along these streets, he was a youth, with only the smallest pittance in his pocket; without a companion to cheer him—without a relative, a friend, even an acquaintance to assist or even counsel him. Yet he seems never to have had a misgiving of the future; never to have hesitated about his course. Though his intellect, his temper, and his personal qualities might have seemed naturally to sway him towards some more attractive and less toilsome occupation, he adhered from the first, to the steady exercise of his trade. Neither his cheerful social nature, nor his many temptations to a desultory life, could lead the youthful wanderer—though unchecked by a father's counsel, unwatched by a mother's care—from the steady practice of his trade. In this, his quick industry early gave him more than common skill; when in want of types, he could contrive himself to cast them; upon occasion he would himself engrave; he made his own printers' ink; he was, as he tells us, his own warehouseman, and brought to his print-

ing-office, in his wheelbarrow, the paper he purchased at the stores; "in short," as he says in the narrative of his youthful struggles, "I was quite a *fac-totum*." Employment soon flowed in upon him; at the age of thirty, his industry had already made him easy in his circumstances; and when, at the age of forty-seven, he received from England a commission to be postmaster-general of the colonies, he had amassed by his business as a printer no inconsiderable fortune. When increasing years and successive public employments obliged him to withdraw from active participation in his trade, he yet retained his interest in it; he watched with unceasing care the progress and welfare of his grandson, who was trained to it in accordance with his wishes; he assembled the printers of Philadelphia around his bed, that they might receive his last advice in regulations that were proposed for its benefit; and among the bequests which he made at the close of life were those of his types, his letter foundry, and his printing-office.

But were there no relaxations in this labor—no hours of indulgence for this energetic spirit, this toiling arm? Was the printer, man and boy, so absorbed in the acquisition and progress of his worldly fortunes, that the story of his life has left us no lesson of attendant enjoyment for himself; has pointed out to us no paths of accompanying usefulness to others? Are there no kindred employments for the intellect and the heart, which may go hand in hand with the busiest labors of a mechanic trade? Is there no philosophy to teach us, but that which is nurtured in the closet; no benevolence, but that which turns to daily and conspicuous wants; no patriotism, but in startling actions of the cabinet or the field? Is there not a self-enjoyment, a philosophy, a benevolence, a patriotism that may wait upon all the occupations of the busiest life, bringing to it happiness that comes unsought for, and gratitude and blessings at which it never aimed? What answer do we need but the life and actions of Franklin.

Without seeking to depreciate the superiority of qualities he possessed by nature, it may yet be confidently said, that of all men who have performed a part so conspicuous on the theatre of life, he reached it by that cultivation of his faculties, that care and forethough of conduct, that wise reflection, that hopeful and trusting spirit, which are within the reach of every human being. If indolence and indifference were foreign to his nature, he yet checked every impulse of unregulated enthusiasm; if his imagination was lively, reason and reflection were ever at hand to control its flights; if he refused a blind deference to authority, he yet respected and weighed opinions adverse to his own; in the controversies of science and of business, he was tolerant towards all opposition; and through the mass of his private correspondence, which accident has disclosed, I do not remember an expression bitter or ungenerous towards those who differed from him in political sentiment or action. If he ever lost the habitual control of his temper or language, in a word that he has written, it is in expressions of angry indignation excited by injuries inflicted on his country.

Yet there was no insensibility in his feelings, or selfishness in his disposition; his impulses were warm and generous; his sympathy was sincere, lively, and comprehensive; he was the ready friend of those who wanted friends—the young, the humble, the unfortunate; a genial humor

and playful wit, and gentle and tender affections brightened the intercourse of his domestic home; his benignity, which had made him a welcome companion in youth and lowliness, gave him, in more conspicuous scenes, a gracious ease that the world admired, but did not envy; and what can surpass the serene dignity of his prolonged old age, which, undisturbed alike by querulousness or levity, was equally preserved amid the splendor and flattery of courts, on the couch of pain, and in the consciousness of approaching death?

Though few men have been more steadily actuated by ambition, though few have more coveted and enjoyed honorable distinction and respect; yet he sought them by the exercise of his talents, by incessant industry, by patient frugality, by tenacity of resolution, by an integrity never sullied, and a social intercourse that brought to him ready confidence and aid; above all, by the unwearied pursuit, for himself and for those around him, of whatever was useful and true. Though never wanting boldness, either in speculation or action, the instincts of his nature were utility and truth; he was cautious even while enterprising; he made the suggestions of imagination subservient to the judgments of his understanding. In his boyhood, he abridged his meals and saved something from his slender wages to gain the time and the means to acquire, by study, variety and accuracy of knowledge. Through life, his busiest occupations could withhold him from no inquiry that seemed to promise a useful result. He held it to be not less a duty than a pleasure for every one, in his own sphere of industry, to contribute something by science or research to the sum of existing knowledge, and his own example is the proof with what ease and benefit that duty may be done. He would not seek, he even declined, patents for his profitable inventions, having, as he said, derived advantages from those of others, and being glad of an opportunity in return, to serve them by means of his own. His philosophy, like the apparatus he preferred to use, was simple, almost homely. No vain love of originality led him into untried speculations. He disclaimed conclusions until they were verified by experiment; when, in familiar correspondence, he suggested a theory, probable and reasonable in itself, but not founded on actual observation, he apologized for his "reveries" as he called them, and for "wandering a little in the wilds of fancy." Yet over what fields of useful science did the busy printer range; what advancing steps of progress did he add to truths already known; what foundations did he lay for many that have been since explored!

Although the wonderful theory, verified by his kite, his finger, and his key, which assured us of the existence of a subtle element through all nature, as pervading and as cogent as gravitation itself, and from the development of which have arisen the most astonishing influences upon the social relations, intercourse and commerce of our age; although his suggestions, experiments, and discoveries in electricity, are the scientific labors by which his fame has been most extended, they yet form but a limited portion of the inquiries of his active mind. Watching external nature with a constant and curious eye, his observations and experiments have laid the basis of the soundest theories in meteorology. Laws unknown before his suggestions, and explained by him with the happiest

clearness and simplicity, are now recognised as governing the wild movements of the winds, the tempests, and the tides. Improvements in navigation; examinations throwing light upon the internal structure of the earth; were some among the many objects of his research. To him we owe the earliest accurate investigation, the first just theory of the great ocean current which sweeps from the gulf of Mexico, whose phenomena are unsurpassed in importance in the hydrography of the globe. Quick as was his mental eye to penetrate far into the future, little could he foresee that one of his own descendants was to perish in that stormy current, in the midst of investigation towards which he had led the way, pursued with the dauntless chivalry of science.

To researches such as these, his native instinct of benevolent utility added inventions and suggestions, more familiar indeed, but even more conducive to the immediate relief, comfort, and protection of those around him. His fire-place, his remedies for smoking chimneys, and his musical glasses; his school for swimming; his establishment of fire companies, of a new city watch, and of a system of cleansing and lighting the streets of Philadelphia; his promptly formed scheme for its defence, when threatened with invasion and without troops, by voluntary associations of the citizens; his artillery club, joined, as he says, by eight hundred, chiefly tradesmen, on the day he proposed it, "and more signing hourly who are to go weekly to the battery, and exercise the great guns;" his plan for the protection and instruction of indigent emigrants arriving from Europe; his effort to introduce the culture of silk, the olive, and the vine—these were but a few of the useful measures by which he was incessantly ministering to daily and conspicuous wants.

Indeed, in his pursuits and in his writings, the philosophy of Franklin was but another name for philanthropy, seeking objects for its exercise in needs and habits constantly occurring, that too often escape attention, though they affect most seriously the actions and happiness of men. The inimitable and amiable simplicity of his style, and its impressive perspicuity were so blended with a shrewd perception of those traits of character and conduct which largely affect the life of every day, as to be constantly conveying lessons of morality that were the more certain in their influence, because they were made attractive but not obtrusive. Through his proverbs, his essays, his apothegms, his parodies, and his almanac, the soundest lessons of industry, sobriety, economy, toleration, and piety stole noiselessly into the heart. No timid distrust turned away from a teacher who approached with a familiarity so gentle and affectionate. No jealous sensibility or wounded pride repulsed truths which were supported by reason and candor, and made alluring by benevolence and fancy. If to those, whose views of philosophy and ethics are more abstract and speculative, his lessons seem to be homely, and his appeals to be directed to our interests rather than to our moral and intellectual perceptions, is it not a sufficient answer that, while they are addressed to some extent to the business as well as to the bosoms of men, they still carefully embody the precepts of goodness, disinterestedness, benevolence, sincerity and religious truth? His moral teaching was not less generous, expansive or profound, because it was illustrated and strength-

ened by an appeal also to those motives of individual benefit which have been planted in the constitution of man, not as antagonists, but as aids of virtue. It is the selected praise of the greatest of uninspired teachers, that his philosophy was that which entered into the households of men, and mixed itself with their every-day manners and affairs, and pointed out the causes which may promote good and ill fortune in ordinary life.

But although the objects of Franklin's personal labor were thus varied, incessant and multiplied; although he thus performed, with such ready generosity and singular felicity, more than a common share in disclosing the advantages and opening the avenues of useful knowledge and instructive truth; he yet keenly felt that much was still left undone, which no individual exertion could adequately supply. If the course of his successful life, and steady adherence to his chosen pursuit, had illustrated the advantages to himself, the usefulness to others, of the mechanic arts, it had equally shown that opportunity of study and the diffusion of new discoveries and progressive science were essential to their improvement and full success; and that these it was scarcely possible to attain except by mutual and voluntary co-operation. The avowed policy of the British Government towards its colonies, had taught them that advancement in the mechanic arts must depend upon themselves. Even where unjust restrictive laws did not actually interfere, yet no royal patronage or parliamentary grants created libraries for them, or endowed societies, or founded schools of instruction, or promoted the diffusion of science. Small as the colonists of America were in numbers, poor in resources, distant from facilities needed for such institutions, they could yet be brought into existence only by their own exertions. These were not long wanting in Philadelphia, under the guidance and influence of Franklin.

In 1731, when he was only at the age of twenty-five, at his instance, to use his own characteristic words, "fifty Philadelphia youths, chiefly artificers, cheerfully instituted the Philadelphia Library." Its object was to secure for themselves and others similarly situated, the best diffusion of the useful literature and instruction that were needed. The necessary funds were supplied by an annual contribution; the contributors annually chose the persons by whom their books were to be selected, and they were allowed to take them from the library for perusal and study at home. The plan was entirely original, and one can scarcely be imagined that could more judiciously have supplied the wants of "the youthful artificers of Philadelphia," at that early day. Franklin chose for it as a characteristic motto—for the young printer was already a tolerable master of Latin—"*Communiter bona profundere Deorum est.*"

In a few years—on the fourteenth of May, 1743—the Library was succeeded by "A proposal for promoting useful knowledge among the British Plantations in America." It was a plan to institute a correspondence among ingenious men, "to be addressed to Benjamin Franklin at Philadelphia, who would act as the secretary, until one more capable should be provided." They were mutually to communicate "such experiments, discoveries, and improvements, as might be thought of public

advantage." From these, selections were to be annually made, published, and circulated. Various subjects were enumerated which should engage their labors, and among them were particularly mentioned "new and useful improvements in any branch of mathematics; new discoveries in chemistry, such as improvements in distillation, brewing, and assaying of ores; new mechanical inventions for saving labor, as mills and carriages, and for raising and conveying water, and draining meadows; all new arts, trades, and manufactures that may be proposed or thought of; all philosophical experiments that let light into the nature of things, tend to increase the power of mind over matter, and multiply the conveniences or pleasures of life." It proved to be impossible at that early day to carry out this excellent plan with all the success that had been hoped for. The scattered population of the colonies, and the expense which was necessarily involved in its full execution, raised difficulties that could not be overcome; but the American Philosophical Society ultimately arose from it, and achieved, as it still continues to do, no inconsiderable portion of the objects at which Franklin had aimed. Two years afterwards he made another effort to supply the place of the annual publication, which he had thus proposed to circulate, for the diffusion of useful science. He offered himself to print and publish a monthly or quarterly journal devoted to matters of invention, and generally to subjects of philosophy. From the same causes this was attended with the same ill success; the expense was beyond his individual means; and he had no alternative left for the accomplishment of his design, but to communicate plans and suggestions of practical utility on scientific discovery through the medium of his newspaper, and by means of occasional pamphlets of his own.

In the year 1749, a third step was taken by Franklin; the establishment of a system of education more extended and useful than any that had previously existed in Philadelphia. There was, at that time, no school of mechanics, scarcely one for the rudiments of mathematics. He proposed, in addition to the general branches of education, especially to provide mathematical instruments; an apparatus for experiments in natural philosophy; prints of all kinds of buildings and machines; instruction in mechanics; and lectures in mechanical philosophy, so that the student, as he says, "might be informed of the principles of that art by which weak men perform such wonders, labor is saved, and manufactures are expedited." I cannot omit to mention the clause which immediately follows this description of scientific studies, as it is peculiarly characteristic of the constant presence of Franklin's benevolence of nature. "With the whole," he adds, "should be constantly inculcated and cultivated that benignity of mind which shows itself in searching for, and seizing every opportunity to oblige." This plan was successful. It received liberal aid from the citizens. It laid the foundation of the Academy, the College, and eventually of the existing University. Men, eminently distinguished, have presided in the schools it formed; and science has been taught by a succession of professors, among whom may be mentioned the distinguished names of Rittenhouse, of Patterson, and of Bache.

Thus had Philadelphia, more than a century ago, under the wise counsels and guidance of Franklin, established the principles most to be aimed at in public institutions, connected with mechanic art; voluntary co-operation; the collection of libraries and cabinets; the extension of their use equally to the artisan and the student; plans and models of inventions; instruction in attendant sciences; and cheap publications, at short intervals, which should disseminate discoveries and communicate useful knowledge. All this she had endeavored to introduce. If complete success did not, at once, attend every detail of so admirable a plan, this was only from the inadequacy of means, which was inseparable from the times; it was but postponed to a day of more enlarged resource. But it made Philadelphia, even then, the first seat of science, of mechanic art, of useful literature, in the new world. Upon us, her sons, it has imposed the duty, from which we cannot shrink, of still leading in the march of practical utility—of being foremost to unite the application of science with ingenuity and taste, in the cultivation of those arts "which tend to increase the power of mind over matter, and multiply the conveniences and pleasures of life."

The life of Franklin had now rolled on, in Philadelphia, for more than thirty years. Peace and prosperity blessed the community which he loved. The success of his own exertions in so many works of generous utility, public and private, was the cheering reward of his unwearied efforts. The equanimity and perseverance which had brought prosperity and happiness to himself, made his useful benevolence more and more acceptable to those around him. The years of industry, which had diminished his own personal necessities and cares, had increased the force and dignity of his character, and gave weight to all his suggestions. His name came to be foremost in every good design; it was hailed as the surest promise of success. "Our ingenious printer," said the intelligent Logan, "has the clearest understanding, and is certainly an extraordinary man; one of a singular good judgment, but of equal modesty." Secretary Peters wrote to the Proprietaries in England, when some new and benevolent enterprise was projected, "Mr. Franklin is the soul of the whole."

That a spirit invariably actuated by impulses such as these, from early boyhood, and through all the engrossing necessities of a self-dependent life, would be foremost when needed by the public exigencies of his country, who could doubt? Who could doubt that the career of the statesman would be marked, when times and circumstances should demand it, by every quality of firmness, of temperance, of skill, of wisdom, of justice, of benevolence, so conspicuous in that of the mechanic and the philosopher; that in every public trust affecting most seriously the welfare of his country, he would be first appealed to, his aid and counsel would be first sought; that influences which had proved to be so useful and benign in a narrower and peaceful sphere, would be exerted in emergencies more arduous, with commensurate results. And so it was. Through the long, stormy and eventful period which followed, he was the first to be relied upon, alike in the incipient movement to unite the colonies in a common union; in the protection of their interests in England; in the

vindication, there and in America, of their threatened and outraged rights; in their protracted struggles for independence ; in securing for them aid and alliance abroad ; in forming and maturing their government at home.

As early as 1754, when England sought to enlist the colonies in a combined plan of military defence, and, with that view, invited an assemblage of commissioners to meet at Albany, the quick forethought of Franklin, who was selected as a representative of Pennsylvania, penetrated beyond the mere exigencies of the occasion. He had already perceived, as he believed, more than one indication of a future policy to oppress the colonies by legislation in England, not directed to promote their benefit, but what was supposed to be that of the mother country. He saw in the present scheme an opportunity, which he instinctively seized, to suggest to his countrymen the plan of a comprehensive political union among themselves, founded on popular representation, and securing the powers of independent legislation. Sixty years before, Penn, looking in his liberal policy beyond the limits of his own province, had aimed at the same object, but the suggestion was in advance of his age, and had met with no response. If Franklin, the son of Pennsylvania next most distinguished, did not fully succeed in this, the second effort, resisted as it promptly was by the ministers of England, and not perhaps acceptable to some of the colonies themselves, who could not view without distrust any surrender of their individual rights, he yet planted the seed of a federal union in the hearts of the people, and it waited but for time and circumstances to produce its fruit. The plan he had thus proposed, and the services he rendered on the occasion, gave him a new and loftier position ; he came henceforth to be regarded, not as a representative of Pennsylvania alone, but of the people of all the colonies ; on his journey homeward, the evidences of this feeling were enthusiastically displayed, and leading citizens flocked around him with warm expressions of grateful respect.

But few years elapsed before the language and conduct of the mother country actually disclosed her purpose of arbitrary oppression. Yet America did not at first believe that this was a settled policy, or that the government would be deaf to an appeal which should be enforced by reason and unaccompanied by passion. This appeal Pennsylvania promptly determined to make. Her legislature selected and deputed Franklin as her agent, to check, if possible, at the outset, by his personal influence and remonstrance, the proceedings that appeared to be contemplated. He was sent to England as the agent of the colony, bearing with him resolutions of the Assembly which remonstrated against the threatened measures as cruel and unjust. Massachusetts, New Jersey, and Georgia, delegated to him the same arduous trust.

With what temper, zeal, and talent, he discharged it, through ten trying and irksome years, forms a chapter, unsurpassed in interest, in his country's annals. What scene more impressive does history portray—what picture more striking is there in the page of Livy—than when he stood, in simple dignity, before the parliament of England, meeting every question ; explaining every circumstance ; seeking to dispel, by the light

of truth and good sense, the fatal illusion that prevailed around; and is there an incident in modern history more deeply engraved on the memory, than the unmoved consciousness of duty with which he bore the ungenerous taunts of the gathered nobles of England, at the council board of her infatuated sovereign? With what calm disdain did he receive and despise the scarcely disguised appeals that were made to his interest or ambition; with what unmoved resolution and subdued temper did he treat every effort to coerce him by injuries and threats? "I do not think," said Howe, "of influencing you by any selfish motive, but certainly you may with reason expect any reward in the power of government to bestow." "The revengeful temper, attributed by poetic fiction to the bloody African, is not surpassed by the coolness and apathy of the wily American," was the language of Wedderburn, cheered and applauded by peers of England, assembled to listen to the preconcerted denunciation. Yet, let it be said, the mad injustice was not cheered and applauded by all. Her wisest statesmen knew that, if the crisis could be stayed, it must be done by listening to the warnings of Franklin; and friend after friend, embracing names the most illustrious, could not be detained from flocking around the patient, sagacious, just and well informed representative of the oppressed and struggling colonies. Chatham above all, the greatest of her patriot sons, anxiously sought and profited by his counsels; and, as if to give by his actions a proof of his confidence the most solemn, he sought to illustrate it by the personal exhibition of his admiration and respect, in the public and brilliant theatre of his own memorable triumphs.

During the last days of Franklin's residence in England, when his close departure was at hand, when all hope of reconciliation seemed to be fading away, Chatham, though feeble from age, and secluded by illness in his country retreat, resolved to attend the assembled parliament, and make one last attempt "to prevent," as he said, "a civil war before it was inevitably fixed." He announced to Franklin his intention. He requested him to be present in the House of Lords. His son-in-law, the Earl of Stanhope, conducted him there. Those most conspicuous in England's history were assembled. The ante-chambers and the galleries were filled with eager listeners. Dreading the power of "the old man eloquent," the unbending ministers had rallied all their forces. All the statesmen in whose hearts still lingered a faint hope that the reckless policy might yet be changed, crowded into the tapestried hall. After discussing, with even more than his usual eloquence and power, the history of the wrongs done to the colonies, and the headstrong pertinacity with which every plan of reconciliation had been rejected, he adverted to the injuries that had been wantonly heaped on the agent they had chosen to present their wrongs, and to suggest measures of forbearance, justice, and peace. Turning his eyes to Franklin, and attracting to him the notice of the vast assemblage, he paid him the memorable tribute of his confidence and respect. "If," said he, "I were the first minister of this country, and had the care of settling this momentous business, I should not be ashamed of publicly calling to my assistance, a person so perfectly acquainted with the whole of American affairs, and so injuri-

ously reflected on; one whom all Europe holds in high estimation for his knowledge and wisdom, and ranks with our Boyles and Newtons; who is an honor not to the English nation only, but to human nature." These were the parting words which cheered him when he closed his fruitless mission. Yet it had not been altogether fruitless, for it had become apparent, even before the fatal gauntlet was actually thrown down, that the general judgment of the civilized world had already pronounced itself in favor of the weak and distant colonies, who were entering into a struggle so fearful with an adversary so powerful; and surely it is not too much to say, that this sentiment was due, in a more than common degree, to the conduct and language of Franklin, throughout the period of his agency in England.

Was it surprising, then, that when he returned to America, he should be placed, with a confidence that absence had not impaired, in the front rank of those who were to lead the country through the impending contest? He reached Philadelphia on the fifth of March, 1775. On the following day he was unanimously added to the delegates already appointed to represent Pennsylvania in the Continental Congress which was about to meet. A few weeks afterwards, the Legislative Assembly of the province constituted a Council of Safety, charged with the executive measures which were now to be adopted, since war had become inevitable. Over this council he was appointed to preside with the same unanimity. At the election which soon after occurred for members of the legislative Assembly, he was chosen to represent Philadelphia. He was now in his seventieth year, yet his activity of mind and body was undiminished. "My time was never more fully employed," he writes to Dr. Priestley in England, early in July. "In the morning, by six, I am at the committee of Safety, which holds till near nine, when I am at the Congress, which sits till four in the afternoon. Enough has happened, one would think, to convince your ministers that Americans will fight. England, I conclude, has lost her colonies forever. She is now giving us such miserable specimens of her government, that we shall ever detest and avoid it as a complication of robbery, murder, famine, fire and pestilence." The temper which personal outrage did not rouse, could not be repressed under the long brooding public wrongs that were now breaking upon his country. Two weeks afterwards he introduced a measure into congress which was in fact a declaration of independence; he presented a plan for a confederated government, independent of England, with a declaration that it should be perpetual, unless all that the colonies had claimed from her was conceded to them. He repaired, at the head of a committee of Congress, to the camp at Boston, to mature with Washington, an efficient system for the organization and support of a continental army. He did not shrink from the fatigues and exposure of a journey to Canada, at an inclement season, attended though it was with serious injury to his health. He personally supervised the construction of works of military defence on the Delaware. He undertook and effected the re-organization of the post-office establishment, which had been broken up by the disorders of the times. Well might John Adams record, as he has done, in his diary, "his capacity for business, and his

memory and resolution are amazing." What services he rendered, even more valuable than these active labors, in the deliberations of Congress during the succeeding years; how he reconciled conflicting interests; how he promoted the just and irrevocable step of independence; how he contributed to form a permanent confederacy, are a few among the characteristic and well known measures of his short and admirable service there.

But far advanced as he now was in years, and various and illustrious as his career had been, there yet remained for him a part to be performed perhaps more brilliant, though it could not be more useful, than all the past. If the sympathies of the European nations were indeed with the young republic, they yet doubted its ability successfully to contend with so powerful a foe. The memory of her triumphs by land and sea, but a few years before, and of her conquests on the continent of America itself, warned them of the dangers to be encountered, and made them reluctant to plunge themselves into the conflict. Congress, however, believed that they would not look on with apathy; that they would be willing to receive them into the family of independent nations, to cultivate relations of harmony, and to enter at least into treaties of commerce; above all, they believed that France, the ancient rival of England, and smarting from late reverses, would not suffer them to sink from want of efficient and timely aid. They selected, therefore, Franklin and Jefferson to repair as commissioners at once to France, uniting with them Deane, who was already there, having been engaged in procuring munitions of war. Franklin, regardless of the season or his years, did not hesitate to accept and immediately to enter on his mission, and after a stormy voyage reached France in December, 1776. Jefferson being unable to do so, Lee, who was then in Europe, was substituted for him, and went soon afterwards to Paris.

The personal fame and character of Franklin, not less than sympathy with America, prepared for the aged representative of the young republic a reception enthusiastic beyond example or expectation. It was not the ambassador alone who was welcomed, but the statesman, who, in England and his own country, had displayed, under circumstances the most difficult, such integrity, patriotism, patience, sagacity and skill; the moralist, whose lessons had been transferred from newspapers and almanacs into various languages of continental Europe; the philosopher, who had been placed by the unbought suffrages of men of science in their own most distinguished ranks, and whom the king of France had himself selected, but a few years before, to fill one of the few chairs appropriated to foreigners in her Academy of Science. "The virtues and renown of Franklin," to use the language of a French historian, "negotiated for him." Supplies of money and of military stores were at first permitted, and afterwards openly and generously furnished; large draughts drawn on him by congress, without adequate provision being made to meet them, were redeemed by the government of France, "mainly owing," as her prime minister declared, "to her appreciation of the patriotism and wisdom of his conduct;" military officers of distinction, whom he recommended, were not restrained from repairing to America; a treaty of amity

and commerce, first acceded to, was ultimately joined with one of military alliance and aid; fleets and armies soon openly followed; when the cheering news of such a result reached the camp of Valley Forge, it filled the hearts of Washington and his suffering soldiers with brighter hopes, if not with more devoted courage; and Morris but spoke out the feelings of all America when he exclaimed, "our independence is now secured; our country must be free."

At home, step by step, through the three years that followed, success attended the military struggle, till at length, beneath the ramparts of Yorktown, the last soldiers of the mother country acknowledged the final triumph of her sons. Abroad, the same years were occupied by wise negotiations with a view permanently to secure, when peace should come, the advantages that had been won by arms. Of these, Franklin was the acknowledged centre, so regarded alike in America and in Europe—by his own countrymen and by foreign governments. The sole negotiator in Paris during the whole of this period, with the exception of a few months in its earlier and closing portions, he was called upon to meet with firmness, but yet with temper and prudence, the reluctant advances which events were forcing from England; to preserve with France that difficult mean between a just sense of grateful obligation for essential and timely aid to his own country, and the candid maintenance and protection of that independence in her policy and conduct, which was required by her own position and the character of her institutions; and, finally, to promote and place upon broad principles of national intercourse, the new relations to be made with other governments of Europe, who were to receive, not without some hesitation, the young and self-created republic, as their associate in the family of nations. All this he did with united sagacity, patriotism, firmness, justice and amenity; and in a philanthropic spirit new in the language and provisions of treaties.

When the negotiations which were to terminate the war with the mother country drew towards their close, and he was joined in Paris by Adams and Jay, the colleagues whom Congress had united with him, he had already laid down the positions on which only peace was to be made, securing to America acknowledged independence, defining the boundaries of her territory in its fullest extent, providing for the continued use of the fisheries as it existed before the war, asserting the free navigation of the Mississippi, and placing trade on the most liberal footing of reciprocity. With what calm steadiness he adhered to these positions whilst acting alone; with what firmness and ability he was upheld in them by the patriotic and vigorous statesmen who were finally joined with him, are among the memorable incidents of American history. If the commencement of the revolutionary contest was characterized by a fearless spirit, refusing, at every hazard, to submit to wrong; its closing act also was at once so temperate yet so complete, as to present the spectacle, not always found in history, of a war begun from necessity, pursued with success, and closed without a demand susceptible of reproach.

All, however, that Franklin had desired was not achieved. He had cherished in his heart the hope that the day was come, when nations

would be willing to yield to impulses which individuals would be ashamed to controvert or resist. It is not among the least of Franklin's honors that, in an early stage of his unaided negotiations—acting from his own clear sense of right, and of the benefits which follow its observance, not less with nations than with men—he proposed, among the articles which he submitted to England, as the basis of peace, a mutual compact to exempt from hostile capture all vessels and their cargoes which might be engaged in peaceful commerce, and to prevent altogether the employment of private armed vessels as instruments of warfare. England rejected his proposition, but it remains a monument of his foresight and world-wide philanthropy, and signs are not wanting, in our own day, to show that it may yet become a corner stone in the intercourse of civilized governments.

When the treaty of peace with England was finally signed, Franklin had reached his seventy-seventh year. His great mission performed, he earnestly solicited the leave of Congress to return to America, that he might pass, in the repose of his family, the declining evening of his lengthened day. Anxious that his great and venerated name, and his enlightened judgment should still serve his country a little longer, in effecting the commercial treaties which it was yet their desire to form, Congress withheld for a time the permission that he sought; and it was not until the summer of 1785, that he left Europe. His last public act, while there, was the most accordant with his sentiments that he could have been called on to perform. At his house in Passy, on the ninth of July, two days before his final departure, he placed his name to a treaty with Prussia, in which the principles he had so deeply at heart were acceded to by the wisest of the sovereigns of Europe. The public acts—performed almost at the same instant—with which Frederick closed his great career, were the ratification of the voluntary union he had accomplished among the States of Germany, and of a treaty with America, which, in the language of Franklin, was to promote "the interest of humanity, and diminish the occasions and the inducements of war." In addition to the immunity of private property, the unimpeded pursuit of commerce in time of war, and the prohibition of privateers, this memorable treaty—the treaty of Franklin and of Frederick the Great—abolished blockades, exempted even contraband goods in private vessels from confiscation, protected the property by the flag, and stipulated for the security of prisoners of war from every species of hardship and oppression.

The passage of Franklin through France, and his reception in America, were spontaneous testimonies in one country and the other, from admiring and grateful people whom he had lived among and served. That the infirmities of age might not be aggravated by the fatigue of his journey from Paris to the coast, the easy litter of the Queen of France was offered for his use, and men of illustrious names tendered to him, as he passed along, the repose of their ancestral homes. When the vessel that bore him came in sight of Philadelphia, his friends crowded in boats to greet him; he landed on the shore among a vast assembled throng; and he was borne to his home, almost in their arms, amidst shouts of welcome, and peals of cannon, and ringing of bells.

Did age and service secure to him at last his longed for repose? His countrymen were unwilling to concede it. When he was once again in their midst, they could not deny themselves the benefit of his coveted counsels, the suggestions of his comprehensive spirit, and the influence of his regulated and benevolent patriotism. Though eighty years had silvered his locks, they had not weakened his intellect or chilled his heart. With the termination of the revolution, Pennsylvania was again to cultivate the arts of peace; her resources were to be developed; the obligations created by the exigencies of war were to be redeemed; the asperities of political conflicts were to be assuaged; the train of useful domestic legislation was to be resumed. What guide in such a path could be found like Franklin? He was invoked by the general voice to accept the post of President of the Commonwealth: he held it for a year; again and again he was unanimously re-elected; and at last, not age, but the provisions of the Constitution alone saved him from further service, and obliged his fellow-citizens to allow him to retire. These three years in the history of Pennsylvania are not indeed marked by thrilling events which excite the fancy or arouse the passions, but they exhibit, in a more than usual degree, with what rapidity and ease a popular government can enter upon the policy demanded by a new position. Under the guidance of Franklin, measures were adopted to regulate the finances, to redeem the obligations incurred during the war, to develop internal commerce by roads and navigation, and to regulate and improve the various branches of domestic administration. One measure especially secured his favor and exertions. A legislative act was passed to promote the use of the steamboat, invented by Fitch, and already tried upon the Delaware. Franklin had watched the experiment with characteristic interest, and did not hesitate to foretell its future usefulness; a prophecy destined to be realized in a few short years, with a success even beyond his expectations, by the more perfect invention of Fulton, another of Pennsylvania's sons.

There yet remained for Franklin one more duty to perform, in order to close the circle of patriotic usefulness and service. As it was the last, so was it, perhaps, the greatest in importance and benefit to his country. Among the earliest of his political efforts, he had sought, although then without success, the union of the colonies. When independence was declared, he had early framed and presented a plan of confederation among the states; but under circumstances that necessarily made it imperfect and incomplete. When he returned to America from France, it was among the most ardent of his wishes, that a more perfect union should be formed among the people and the States, which should secure for them a common government as a united people. "May God grant," said Filangieri, the generous and philosophic statesman of Italy, at the moment when Franklin was leaving Europe—"May God grant that your advanced age may not prevent you from strengthening, and perfecting, and placing upon an eternal foundation, the work that has been achieved by a just indignation, and by the valor of a great people, who are invoking blessings on your name."

When the convention, chosen to form a constitution, assembled, Vir-

ginia and Pennsylvania had deputed, at the head of their delegations, the two most illustrious of their sons. The common voice of their country placed them first, even among the men who formed that august assemblage. Though the position which Washington was called to fill, and the years and infirmities of Franklin, obliged them to leave to others its more active labors and discussions, yet, who can sufficiently estimate the value of their counsels and their life-long services; and the influence of their tempers so calm, benevolent and patriotic, in soothing, in conciliating, in binding together, elements often discordant, and interests and feelings which local circumstances could not fail to make occasionally adverse? Although no record now discloses to us the full extent of the dangers which more than once theatened a disastrous result, yet it is known that they were subdued, at periods the most anxious, by the personal influence of these admirable men. Especially, it is the crowning glory of the great career of Franklin, that in the darkest moment of difficulty and depression, on the question of fiercest conflict, the protection of the rights of states largely differing in extent, population and power, we owe to him the adoption of that feature which distinguishes the American government from all republics and confederacies that have gone before. It was his proposition, in the committee appointed to produce, if possible, conciliation and harmony, that, by a mutual and dependent stipulation, the votes of all the states should be equal in one branch of the legislature, and should be in proportion to population in the other. Perhaps it is not too much to say, that if the American union shall indeed continue, as its founders hoped and designed, to secure to ourselves and our posterity the blessings of liberty, it will be due to this wise provision, at once so simple, so adequate and so just. Fortunate old man!—to whom was granted the privilege of thus erecting for himself, a monument which shall endure as long as his country shall continue to be bound together, by the tie which it was the labor of his life to form.

At the age of eighty-two, Franklin was at last permitted to close the lengthened period of his public service. Yet the consenting voice of those among whom he had lived and among whom he was soon to die, continued to the last, to crown with daily and undiminished evidences of approbation, respect and honor, his latest as they had done his earliest years. A fame, long since justly won in this narrower sphere, had spread farther and wider as time had rolled on, and distant nations had now united to acknowledge, with ready justice, that the course of his life had been a lesson for mankind.

But beyond all this, far dearer to him than the tribute from the world abroad, perhaps even dearer than the tribute from those among whom he dwelt, was the touching language of him, who alone surpassed him in their common country's grateful love, and who saw with sadness the close, now fast approaching, of his usefulness on earth; of him who could bestow no praise which was undeserved, as he was unable to withhold that which was sanctioned by his judgment, and rose spontaneously from his heart. Let me close the estimate I have ventured to express of the character and services of Franklin, with the words of Washington, as they were laid upon his couch, when he was suffering with the pain

of his last disease. "Would to God," are his touching expressions, "that your existence might close with as much ease to yourself, as its continuance has been beneficial to our country and useful to mankind; or if the united wishes of a free people, joined with the earnest prayers of every friend to science and humanity, could relieve the body from pains and infirmities, that you could claim an exemption on this score. But this cannot be, and you have within yourself the only resource to which we can confidently apply for relief, a philosophic mind. If to be venerated for benevolence, if to be admired for talents, if to be esteemed for patriotism, if to be beloved for philanthropy, can gratify the human mind, you must have the pleasing consolation to know that you have not lived in vain. And I flatter myself that it will not be ranked among the least grateful occurrences of your life to be assured, that, so long as I retain my memory, you will be recollected with respect, veneration and affection by your sincere friend."

These were the words of Washington. Memorable words which unite such names together at the close of life. And oh! how cheering to humanity is the thought, that they shall forever remain united, not by their own friendship only, not only by the respect and love of their own country, but by the consenting judgment of the world; that these two men, now so illustrious, but once so humble—the land-surveyer of Virginia and the printer of Pennsylvania—the widow's son and the self-relying apprentice boy—shall stand together on the pinnacle of worldly honor, the best and proudest proof that virtue, and generous love of our fellow-beings, and devotion of life and talents to their welfare, in sunshine or in storm, can secure a glory more exalted than has ever been won by conquerors or kings.

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